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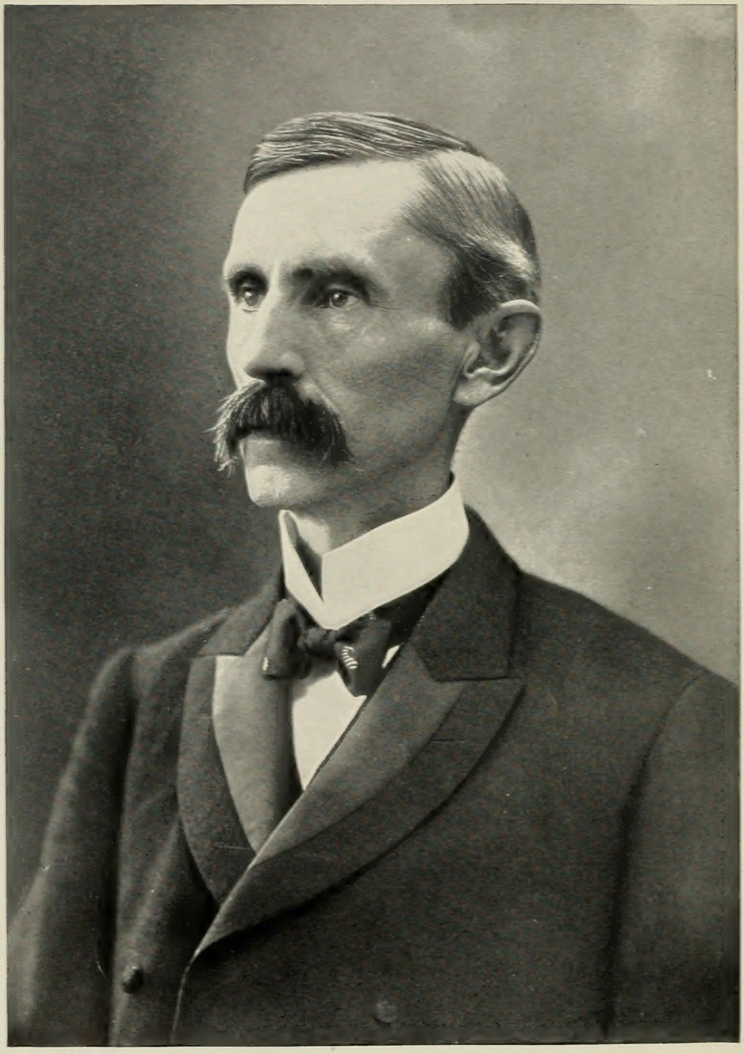

HENRY CULLEN ADAMS, OF WISCONSIN.

BORN NOVEMBER 28, 1850. DIED JULY 9, 1906.

Mr. Adams represented the Second Congressional District of Wisconsin in the Fifty-eighth and Fifty-ninth Congresses. He was an active member of the Committee on Agriculture, and was the author of the act for the increased endowment of the agricultural experiment stations, generally known as the Adams Act.

YEARBOOK

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE.

1906.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1907.

[CHAPTER 23, Stat. at L., 1895.]

[AN ACT providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

PREFACE.

The Yearbook for 1906 closely follows in the main the style and character of its predecessors. The Annual Report of the Secretary of Agriculture is reproduced in compliance with the act of Congress, which requires that the Yearbook shall "include a general report of the operations of the Department."

The special papers contributed by the several Bureaus and Offices of the Department number twenty-five and occupy 332 pages. These papers are all contributed by employees of the Department, and the subject-matter of each is closely related to some line of departmental work.

An earnest effort has been made not only to maintain but to extend the scope and value of the Appendix so far as this could be done without too greatly enlarging its dimensions. It may be stated here, as an answer to many inquiries, that it has been found impossible to admit any but national associations in what may be termed the agricultural directory, which forms an important part of the Appendix.

More than usual attention has been given to the presentation of agricultural statistics, as these constitute one of the most important features of the Yearbook. There appear in this volume all the usual Yearbook tables showing acreage, production, prices, values, etc., of the principal farm crops of the United States, production of the same crops in nearly all foreign countries, international trade in many leading products, and statistics of all the principal animal industries. The exports and imports of agricultural products are presented with the usual fullness. One very valuable feature of these statistics is the presentation of data for previous years (usually four or more) so that comparison may reveal the increase or decrease of production or trade.

The statistical portion has also been considerably enlarged by including a number of new tables. The most important of these are tables giving statistics of the cotton crop of the United States for one hundred and seventeen years (1790–1906); production of sugar in the United States and its possessions for fifty-three years (1854–1906); and farm and factory results in the beet-sugar industry for six years (1901–1906). The statistics of international trade have been amplified by the inclusion of tables showing the international trade in corn,

wheat and wheat flour, hops, tea, coffee, oil cake and oil-cake meal, resin, spirits of turpentine, india rubber, wood pulp, hides and skins, butter, and cheese. Many of the facts embraced in these new tables are, it is believed, brought together and presented in this form for the first time in any publication.

The Appendix includes a review of weather conditions during the crop season of 1906; a review of the live-stock industry during the year, involving a statement of the greatly increased scope of the Government meat inspection; reports on plant diseases, and the principal injurious insects in 1906; the areas surveyed and mapped by the Bureau of Soils; an account of what is being done under the new "pure food law;" a report on the progress of forestry, and a report on game protection for the year.

The portrait of Hon. Henry Cullen Adams, Representative in the Fifty-ninth Congress for the Second district of Wisconsin, has been selected for the frontispiece. In view of the conspicuous services rendered to agriculture by Mr. Adams during his public career, recently cut short by death, this selection will be appreciated by the friends of agriculture throughout the country.

The tendency in past years has been to increase the size of the Yearbook. This tendency has been rigorously controlled in the present volume, with the result that it contains nearly 100 pages less than the Yearbook for 1905, and only 43 plates, as against 73 in the previous volume. The result has been to produce a volume more convenient in size than several of its recent predecessors.

GEO. WM. HILL,
Department Editor.

WASHINGTON, D. C., *May 29, 1907.*

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YEARBOOK

OF THE

U. S. DEPARTMENT OF AGRICULTURE.

REPORT OF THE SECRETARY.

Mr. President:

In presenting my Tenth Annual Report of the work of the Department of Agriculture, the position of the producer from the soil in the development of our country is indicated.

It will be seen that he is making progress in the sciences and arts of agriculture; that the researches of the Department and of the experiment stations are enabling him to meet the requirements of a growing population for larger quantities of field products; that the time of the man and the yield of the acre become more responsive as more imperative demands are made upon them; that our research extends to all the States and Territories and to our island possessions; that every feature of interest in soils, plants, and animals has due attention; that explorations during the past year in extreme northern latitudes of Europe and Asia have resulted in accessions of plants suitable to our dry regions that promise to help in bringing them into profitable production.

The laws made by Congress at its last session to be put into execution by the Department have required and have received special attention. The meat law is being enforced with but little friction. At this time inspection is made in about 1,000 houses, and about 1,300 experts have been added to the inspection force of the Bureau of Animal Industry.

Rules have been made, as required by Congress, for the execution of the pure-food law, and hearings are being given to parties interested. The law regarding the extermination of the cattle fever tick (*Boophilus annulatus*) of the Southern States is being put in force and good results are following. Progress is being made in dealing with the gipsy and brown-tail moths in New England, imported parasites being successfully established. A beginning has been made in determining correct rules for grading grain and acquiring facts regarding methods of handling it in its movement toward the market.

The law providing for the humane treatment of live stock in transit is receiving careful consideration, and violations will be reported to the Department of Justice.

REVIEW OF PRODUCTION.

NATIONAL DEPENDENCE ON AGRICULTURE.

Economic revolution in the art and science of agriculture, which became noticeable in this country half a dozen years ago, has continued during 1906, with tremendous effect upon the nation's prosperity.

Crops so large as to be beyond any rational comprehension have strained the freight-carrying ability of railroads. Directly and indirectly the farmer has set up a demand for iron and steel that has exceeded the productive power of the chief producer among nations. His contribution to the supply of loan capital has been beyond calculation and recalls the fact that the depression in the loan and investment market of 1903 was cleared away by the following crop.

Meanwhile the farmer has been a generous consumer, and has given powerful support to the market of the industrial producer, to the trade of the merchant, and to the wages of the workingman.

The farmer has become aware of the importance of the place that he occupies in the Republic, and in the pride of his occupation he is ready to offer this yearly account of himself to the people.

Preliminary crop estimates, subject to modification, must be used in the following review of the year's farm production, in advance of the final estimates of the Department, to be made a little later. The estimate of total agricultural wealth production has been continued from previous years and is again presented as an indication of the financial results of the year's operations. All attempts in the past, by subtracting from this grand total of value such products as are used wholly or in part in the making of other farm products in order that the farmer's net wealth production might be ascertained, have given no indication of what that net production was and have only obscured the matter.

TOTAL WEALTH PRODUCED.

Taken at that point in production at which they acquire commercial value, the farm products of the year, estimated for every detail presented by the census, have a farm value of $6,794,000,000. This is $485,000,000 above the value of 1905, $635,000,000 above 1904, $877,000,000 above 1903, and $2,077,000,000 above the census for 1899.

The value of the farm products of 1906 was 8 per cent greater than that of 1905, 10 per cent over 1904, 15 per cent over 1903, and 44 per cent over 1899.

A simple series of index numbers is readily constructed, which shows the progressive movement of wealth production by the farmer. The value of the products of 1899 being taken at 100, the value for 1903 stands at 125, for 1904 at 131, for 1905 at 134, and for 1906 at 144.

GAINS AND LOSSES.

Analysis into items of the grand total of wealth produced discovers that most of the increase over 1905 is due to horses and meat animals, and this is so partly because of the Department's much increased estimate of the number of these animals last January, and more largely because of higher prices than a year ago.

The price of milk ran higher than in 1905, but the value thus gained in wealth produced was perhaps more than offset by the lower prices for butter. So, in the case of poultry, the gain in live and dressed poultry was more than balanced by the reduced egg value, since the mean farm price of eggs, as ascertained by this Department, declined from 18.7 cents during 1905 to 17 cents during 1906.

Crops, in a general balance of gain against loss in value, in comparison with the crops of 1905, have made substantial but not large gain—about $22,000,000; so that the previous foremost year in value of products, 1905, is exceeded by 1906 in both crops and animal products, and thus this year became the leading one in value of farm products in the history of the country by $485,000,000 over 1905.

On the side of gains over 1905, two short crops are conspicuous; hay leads with a gain of perhaps $80,000,000 in value, and the oat crop is second, with a gain of possibly $14,000,000. Barley and cottonseed each promise a gain of $10,000,000; beet sugar, $7,000,000; tobacco, $2,000,000 or more; and hops, $1,000,000.

Against these gains are the losses of three abundant crops—$60,000,000, more or less, for wheat, and $10,000,000 each for corn and potatoes. The loss on rye and cane sugar may be about half a million dollars each, if anything. The net decline for all cereals may be $40,000,000.

The foregoing gains and losses in value, as well as others not mentioned, are exceedingly uncertain, and are to be regarded only as indicative of a general conclusion.

CHIEF CROPS.

All cereals.—While the value of all cereals dropped about $40,000,000 below the total of 1905, and about $12,000,000 below the total of 1904, the number of bushels for 1906, which was 4,688,000,000, was 120,000,000 bushels above the yield of 1905, 570,000,000 above the yield of 1904, and 835,000,000 bushels above the yield of 1903.

CORN remains by far the most valuable crop, and the figure that it may reach this year is $1,100,000,000 for 2,881,000,000 bushels—perhaps a little under the value of the next largest crop, that of 1905.

THE COTTON CROP, fiber and seed combined, follows corn in order of value, although it is only three-fifths of the value of the corn crop. No comments here must be regarded as indicating what the Department's estimate of the cotton-fiber production is to be. Upon the basis of the general commercial expectation of a crop, it should be worth to the grower nearly $640,000,000. In Texas alone the cotton crop is greater than that of British India and nearly three times that of Egypt, and it is half as much again as the crop of the world, outside of the United States, India, and Egypt.

HAY is a crop that receives small popular attention, and yet it is the third one in value if cotton seed is included in the cotton crop, and this year it approaches $600,000,000 for a product that is short by perhaps 8,000,000 tons.

WHEAT.—The fourth crop in order of value is wheat, which this year may be worth over $450,000,000, a value that has been exceeded in several years; but in quantity this year's crop, with its 740,000,000 bushels, is only 8,000,000 bushels below the largest crop grown—that of 1901.

OATS.—The crop of oats, on account of unfavorable weather, has fallen below the usual amount, but its value will be perhaps not far under $300,000,000, or about the same as for 1905, and not much under the highest value reached, in 1902.

POTATOES.—With a probable crop of fully 300,000,000 bushels potatoes reach next to their highest production, which was in 1904; but the total value, $150,000,000, rests upon a rather low average per bushel and has been exceeded in other years.

BARLEY.—Seventh among the crops in order of value is barley, a cereal that has gained 21 per cent in production in seven years. The 145,000,000 bushels grown this year may be worth $65,000,000, both bushels and dollars being much more than for the highest preceding years—1904 being the previous record year for yield and 1902 for value.

TOBACCO, which has shown weakness for several years on account of low prices, while not yet recovering its former place in pounds grown, has a crop this year of 629,000,000 pounds, with a value which is in close company with the three years of highest value, and it is expected will be worth $55,000,000, or perhaps $2,000,000 more.

SUGAR.—A remarkable development has been made within a few years by now the ninth crop—beet sugar. The production in 1906 is placed at 345,000 long tons, with a value supposed to be near $34,000,000. Seven years ago only 72,972 tons were produced, and their value was about $7,000,000.

The year was a rather bad one for cane sugar, but in spite of this the total production of beet and cane sugar slightly exceeded the highest previous figure, although in value of sugar the year stands second. The value of all kinds of sugar, sirup, and molasses reaches a total of $75,000,000, second only to 1904, which was cane sugar's best year.

FLAXSEED.—The 27,000,000 bushels of flaxseed have been exceeded by three years, although the value, $25,000,000, reaches the highest point.

RICE, standing twelfth in order, is another crop with its highest value, perhaps $18,000,000, although in production the 770,000,000 pounds of rough rice are second to 1904. Markets that have developed in Hawaii and Porto Rico have helped to keep the price high enough to account for the total value placed upon the crop.

RYE has become a minor crop and has now fallen below rice in value. The crop of this year is below the larger crops of recent years, and is about 28,000,000 bushels, worth perhaps $17,000,000.

HOPS.—The fourteenth crop is hops, which reached its largest dimensions this year with 56,000,000 pounds, and as high a value as it ever had, except in 1904, say, $7,000,000.

SUMMARY.—On the whole, crop values have been neither notably high nor low in comparison with recent years, but the crops are so many in number that losses meet gains, and the crops have been on such a high price level in the general average that they have raised the total crop value somewhat above 1905 and the high preceding years. To reach a still higher point in this extraordinary series of high annual values than had been touched before is an achievement that deserves attention.

EXPORTS OF FARM PRODUCTS EXCEED FORMER YEARS.

Farm products continue to be so far beyond the national requirements that the farm still overshadows the mill, the factory, and the workshop in providing exports. With his surplus beyond the nation's need, the farmer has loaded the fleets of oceans. These products were exported to the value of $976,000,000 during the fiscal year ending June 30, 1906—enough to build a high-class railroad halfway around the earth. This is the largest amount ever reached by agricultural exports for this or any other country, and exceeded by $24,000,000 the extraordinary value of 1901, which had previously been the record year.

PRINCIPAL ITEMS.

Principal among the items that make the increase over the fiscal year 1905 are grain and its products, chiefly wheat and flour, for which the gain was $79,000,000; packing-house products, for which

the gain was over $37,000,000; cotton, $19,600,000; various seeds, $6,355,000; dairy products, $3,900,000; and live animals, $2,400,000. Products exhibiting a decrease were mostly inconsiderable. In hops, the decline was $1,355,000; tobacco, $992,000; vegetable oils, $726,000; fruits, $440,000.

HIGHEST VALUE OF COTTON EXPORTS.

Cotton maintains its long lead over other chief exports, with a value of $401,000,000 for 3,634,000,000 pounds, so that the latest year was exceeded only by 1898, 1899, and 1905 in quantity exported; but in value of exported cotton the figures for 1906 are $19,600,000 higher than for 1905, which was previously the record year, and $29,000,000 higher than for 1904, which was third in order in the value of these exports.

In exports of grain and grain products for 1906 the value again reached a high amount and has been exceeded only 13 times in the last fifty-six years. The value of this class of exports last year was almost exactly the average of the preceding twenty-five years.

LEADING YEAR FOR PACKING-HOUSE PRODUCTS.

Packing-house products are another class of exports that found their leading year in value in 1906, the amount being $207,700,000. No previous year had reached $200,000,000, and only two years had passed $180,000,000. The value of exported fresh beef, $24,300,000, was well up to the average of recent years; lard exports to the value of $60,000,000 and a quantity of 742,000,000 pounds went far beyond the highest figure of preceding years in both respects; bacon took an upward turn with exports valued at $36,000,000 for 361,000,000 pounds and rose well up toward the higher export years of the past. The level of recent years was reached in the exports of hams, their value being $20,000,000 and weight 194,000,000 pounds. The highest exports, both in quantity and value, of oleo oil in previous years were far overtopped by the exports of this commodity in 1906, and the 210,000,000 pounds exported were valued at $17,500,000.

IMPORTS OF FARM PRODUCTS.

The imports as well as the exports of agricultural products reached their highest value in 1906, when the amount was $554,000,000, or less than one-fourth of a million dollars over the value of 1905, which was then the highest record. The principal increases over 1905 in these imports were $20,000,000 for packing-house products, almost entirely composed of hides, skins, hair, and bristles; $4,400,000 for tobacco; $2,700,000 for vegetable fibers; $1,900,000 each for seeds and vegetable oils; $1,800,000 for fruits; $1,200,000 for nuts; and $1,100,000 for vegetables. On the other hand, there were decreases in imports

which nearly balanced the increases, and principal among these were coffee, with a loss of $11,000,000; sugar and molasses, with a loss of $12,600,000; wool and silk, with a loss of $7,000,000 each; and tea, with a loss of $1,650,000.

The principal imported articles are the same year after year, and among them for 1906 the imports of packing-house products were valued at $96,000,000; of sugar and molasses, $86,000,000; of coffee, $73,000,000; of silk, $54,000,000; of vegetable fibers, $50,000,000; of wool, $39,000,000; of tobacco, $22,000,000; of fruits, $21,500,000; of tea, $14,600,000; and of vegetable oils, $12,600,000.

FOREIGN TRADE IN FOREST PRODUCTS.

On account of the increasing value of forest products, the exports of these commodities in 1906 reached a considerably higher figure than ever before, with a value of $77,000,000, or $13,748,000 more than in 1905. The imports of these products also increased in value by $3,000,000; all items exhibit an increase except india rubber, the imports of which declined by $4,800,000. In total value the imports of forest products were $95,700,000 in 1906, an amount far above that of any preceding year except 1905.

BALANCE OF TRADE.

The so-called balance of trade in the international exchange of agricultural commodities continues to run in favor of this country by an enormous amount; for 1906 the agricultural exports exceeded similar imports by $433,000,000, an amount which places this year with the seven high years beginning with 1898 and much above the balance of 1905. This new foreign credit, which equaled that of a rich nation, was mostly offset by large borrowings in this country from Europe for the purpose of enlarging railroads and other capital.

While the farmer placed to the National credit in other countries $433,000,000 in 1906, other producers, all included, secured a balance in favor of this country of only $85,000,000. During the last seventeen years the farmer has built up a balance of trade in foreign exchange of agricultural products amounting to $6,068,000,000, while all other producers find themselves at the end of the same period with a total on the debtor side of the account to the extent of $459,000,000.

INCREASE OF FARMING CAPITAL.

Having produced fabulous wealth during the year and having sent to foreign countries out of the wealth of the preceding year enough to pay the interest-bearing national debt, the farmer may now take account of his farming capital. The large rate of increase in its value since 1900 is not a mere matter of a higher price level and higher land values. In the meantime the farmer has earned a surplus income,

much of which he has invested in his farming equipment, in buildings, in many improvements, in live stock, in machinery, and in furtherance of the comforts and pleasures of living.

REAL ESTATE AND FARM EQUIPMENT.

The farm real estate, as ascertained by this Department last year, increased in value $6,131,000,000 since the census year, or enough to raise the census value to $22,745,000,000. Domestic animals were worth $2,979,000,000, according to the census enumerators, and now they are estimated to be worth more than $4,000,000,000. There has been a very active demand for implements and machinery, not only by farmers who have become financially able for the first time to buy, as in the South, but by farmers already provided with them, who have needed to reduce their dependence upon human labor by getting more serviceable machines.

If real estate, domestic animals, other live stock, and implements and machinery are combined, the farmers' capital, as composed of these items, has increased by perhaps $8,000,000,000 since the census valuation, or about 40 per cent, and now amounts to perhaps $28,000,000,000.

DOMESTIC ANIMALS.

The domestic animals of the farm number about 200,000,000 at the time for which it is estimated by the Department, which is January 1. Strictly beef cattle, sheep, and swine are each one-fourth of the total, and dairy cows and draft animals each about one-tenth. The value of these animals has increased during the year, and only a very rough estimate can now say how much, in advance of the careful estimate to be made in January. Perhaps the gain is about $400,000,000; at any rate, the increase seems to be as much as 10 per cent.

MEAT SUPPLY.

NUMBER OF ANIMALS SLAUGHTERED.

Upon the farmers' vast herds of meat animals the nation depends for its most expensive class of foods in various kinds of meat and for one-third of its dietary. The figures of meat production, which are the result of a recent large and searching investigation by this Department, strikingly express the magnitude of the farmer's occupation, as evidenced by only one of its branches, and the largeness of its performance in national sustenance and exports.

In the last census year, 1900, 93,502,000 meat animals were slaughtered and exported, and of these 18,809,000 were cattle, including calves; 24,548,000 were sheep, including lambs; and over one-half, or 50,145,000, were hogs. Every time the clock ticks a second during ten hours of a workday the farmer drives nine meat animals to the butcher.

POUNDS OF MEAT PRODUCED.

The meat production of 1900, in terms of dressed weight and weight of edible parts not included in dressed weight, was 19,186,330,000 pounds, of which 2,433,035,000 pounds, or 12.68 per cent, were exported, so that the national consumption was 16,753,295,000 pounds.

Such great numbers may be better understood if they are reduced to the average of the census private family, 4.6 persons. To such a family in 1900 the farmer supplied 49 pounds of veal, 431 pounds of beef, 30 pounds of lamb, 39 pounds of mutton, and 465 pounds of pork, including lard, or, in all, 1,014 pounds of meat, amounting to half a ton.

If the exports had been consumed at home, they would have given to each family more beef than the foregoing by 50 pounds, more pork by 97 pounds, or together 147 pounds.

In the consumption of meat, expressed in terms of entire animals, each family asks the farmer for over one-third of a calf, over two-thirds of a steer or cow, over three-fourths of a lamb, nearly three-fourths of a sheep, and two and one-half hogs, and the farmer responds so liberally that one-eighth of his supply is left over for the foreigner. It is upon the selling of this surplus in foreign countries that the farmer depends for the maintenance of profitable prices for his meat animals.

LARGE PLACE OF THE SURPLUS IN THE WORLD'S TRADE.

This fraction of one-eighth is small, but it becomes remarkably magnified when it crosses the Atlantic Ocean. The national surplus of meat for one year, if composed of the different kinds as actually used in consumption, is sufficient to feed either the United Kingdom or the German Empire for nearly half a year, or both for nearly one-fourth of a year, and the population of these two countries in 1901 was 98,000,000, as compared with a population of 76,000,000 in this country the year before.

This little fraction of the national product of meat which goes to other countries looks large when viewed in another aspect. In the world's international trade in packing-house products and live meat animals the place occupied by the exports from the United States is indicated by about 40 per cent of the total value.

IMPORTANCE OF SWINE.

As a meat producer, the importance of the hog appears in the foregoing statement. The yearly turnover or slaughter of hogs is equal to about four-fifths of the number on hand June 1, and the meat, including lard, produced in 1900 was 9,279,583,000 pounds, or more than

half a billion pounds over the 8,771,263,000 pounds of veal and beef, and over eight times the 1,135,484,000 pounds of lamb and mutton.

In one State alone, Iowa, the pork products for 1906, including lard, are equivalent in pounds to nearly the entire exports of the meat products of swine in 1900. Should Iowa suddenly lose its swine, for the time being exports of their products must substantially cease or the home consumption of them be reduced one-fifth.

Briefly mentioned, such are some of the main results of the Department's investigation of the meat supply. They indicate the proportions of the part that the farmer of this country takes, in only one direction of his work, as a provider of meat to now 85,000,000 fellow-countrymen and to the rest of mankind.

CONSUMERS' YEARLY MEAT BILL.

Meat consumers, as well as farmers who are meat producers, have concern with the national dietary. This nutritive element contributes one-third or more of the total assimilated nutrients of the dietary, both in pounds of protein, or flesh-forming material, and in calories of energy. In expense to the consumer the fraction is undoubtedly much larger. The investigations of the National Bureau of Labor into the retail prices of food indicate, for the many representative family budgets included in the investigations, that the average retail price of meat, for all kinds in the proportions of actual consumption, was 12¾ cents in 1900, 13 cents in 1901, and 13½ cents in 1905; the average increased, perhaps, to 13¾, or at the most to 14, cents in 1906.

At these average meat prices and with the meat consumption of 1900, the national retail meat bill was $2,052,279,000 in 1900, and it was $2,303,578,000 to $2,345,461,000 in 1906. Every increase of one-fourth of a cent per pound in the national average retail price of meat raises the total yearly expense to consumers by $41,883,000. The increase of one cent a pound since 1900 cost consumers this year $167,533,000.

FUTURE PRODUCTION.

FAULTS OF THE PAST.

The mighty production of the farm for one-third of a century has come out of an agriculture having many faults. In a large degree there has been one-crop farming; crop rotation, as practiced, has often been too short and unwise; the grasses and leguminous forage crops have been neglected, domestic animals have not sufficiently entered into the farm economy, and many dairy cows have been kept at a loss. The fertilizers made on the farm have been regarded as a nuisance in some regions; they have been wasted and misapplied by many farmers; humus has not been plowed into the ground as generally as it should have been; and in many a place the unprotected soil has been washed into the streams.

ECONOMIC JUSTIFICATION.

This, in few words, is the historic story of agriculture in a new country; yet the course of agriculture in this country, bad as it may seem in its unscientific aspect, has had large economic justification. While pioneers, poor and in debt, are establishing themselves they have no capital, even if they had the knowledge, with which to carry on agriculture to the satisfaction of the critic. They must have buildings, machinery, and live stock, even at the expense of the soil.

Millions upon millions of acres of fresh land have been coming into production faster than domestic consumption has required, and, at times, beyond the takings of importing countries. For many years the farmer was threatened with 40-cent wheat, 20-cent corn, and 5-cent cotton, and at times he was face to face with the hard conditions implied in these destructive prices. A more scientific agriculture would have raised wheat that no one wanted to eat, corn to store on the farm and perhaps eventually to be used for fuel, and cotton not worth the picking.

LARGER PRODUCTION INDICATED.

So it has happened, with reason, that the production per acre has been low; but there is no likelihood that low production is fixed and that the farmer must continue his extensive system. When consumption demands and when prices sustain, the farmer will respond. The doors of knowledge and example are opening wider to him.

There is abundant information concerning crop rotation, the dependence of high production upon the domestic animals, concerning grasses, clover, and alfalfa, and concerning the mixing of vegetable matter with the soil. Systems of farm management and soil treatment have assumed greater importance in their effect upon production; and there is the breeding of plants, which alone can multiply production so as to glut the market.

MULTIPLICATION OF THE COTTON CROP.

If there were need to do so, the cotton farmer and planter could double the present crop of two-fifths of a bale per acre, and the feat would need nothing more than demonstrated and well-understood principles of farm management. It would be no work of magic to multiply the production of cotton per acre by 3 and get a bale and a quarter; and, besides this, the planter has more than three times the present actual acreage in cotton readily available and awaiting his use. More than the present area of cotton can thus be grown in a three-year crop rotation when the needs of the world demand it.

INCREASE OF CORN.

In accordance with principles demonstrated, known, and applicable, hints of which have been given, the corn crop per acre can be increased by one-half within a quarter of a century, and without any pretense that the limit has been reached. No wizard's services are needed for this, but just education.

MORE WHEAT PER ACRE.

The same statement is applicable to wheat. There is no sensible reason why half as much again wheat may not be had from an acre within less than a generation of time. It is only a question of knowledge, of education, of cultural system, and of farm management, all of which learning is and will be at the service of the farmer as he needs it.

GAIN IN OTHER CROPS.

Equally feasible is a 50 per cent increase in the crops per acre of oats, barley, rye, and buckwheat. Potatoes, instead of growing less than 100 bushels per acre, should double their production. Wherever only 600 to 800 pounds of tobacco are got from an acre, three-fourths of a ton is the prospect.

Fruits, berries, and vegetables have a future too large to estimate. The cannery and the railway fast freight and refrigerator car have overcome obstacles of latitude, of longitude, and of season, and there is every indication that the farmer can supply any possible demand for these foods at home or abroad.

ANIMAL PRODUCTS.

Farmers will learn how to feed more prolific breeds and strains of swine than the ones which they are now chiefly raising, and thus will pork and its products be increased per individual of the permanent stock of hogs. One-fourth of the dairy cows of the country do not pay for their feed, and more than half of them do not return any profit; in proportion as the dairyman weighs the milk of each cow and applies the Babcock test will he increase the supply of milk, butter, and cheese. It is merely a matter of education.

Poultry is one of the steady and helpful sources of farm income. Movements are already on foot which may be expected to increase the egg production per hen by at least a dozen per year within a generation; and there are poultrymen who are not enthusiasts who foretell double that increase. If the hens of this year had each laid a dozen eggs more than they did, the increased value of this product would have been possibly $50,000,000.

A MATTER OF EDUCATION.

The farmer will not fail the nation if the nation does not fail the farmer. He will need education to know the powers of the soil which

are now hidden from him. The prospective yearly expenditure of $10,000,000 for educational and research work by Nation and States, with such increases as may come from time to time, must have enormous effects. There may be agricultural schools for the small children, and agricultural high schools for the larger ones, and their education will be continued in the colleges.

The work of the Department of Agriculture has already had results which are valued at hundreds of millions of dollars annually, and yet the Department feels that it has barely crossed the threshold of its mission of discovery and education. Cooperating to the same ends are 60 experiment stations in 51 States and Territories, the 63 agricultural colleges, thousands of farmers' institute meetings yearly, many excellent agricultural periodical publications and new instructive books. Then there is a new line of work which is so productive of results that it is constantly extending, and that is the demonstration farm, the encouragement of individual farmers to change their agriculture so as to multiply their yields and their profits, and thus afford object lessons to other farmers.

Thus it appears that forces are now at work which will very considerably increase the production of the farms within a generation, and which promise to continue the increase indefinitely. He who would write the last chapter of the progress of the agriculture of this country must await the procession of the centuries.

OPENING OF A NEW ERA.

The farmer is financially in a position now to do what he could not have done previous to the recent years of his prosperity.

ADVANCE OF FARMERS' WELFARE.

National welfare has been promoted by few revolutions in agricultural economics to the extent that it has been and will be promoted by 10-cent cotton. The greater part of the cotton planters are out of their former bondage to future maintenance, and they are paying no enormous rates of interest for advancements—rates which were estimated fifteen years ago to average 40 per cent a year.

In the Middle West the prosperity of the farmers during the last half dozen years and over has advanced in such mass and with such speed that no parallel can be found in the economic history of agriculture. One of the great changes that have come over this region is the conversion of a million agricultural debtors, paying high rates of interest and finding great difficulty in procuring the wherewithal out of prices much too low, into financially independent farmers, debt-free, and begging the banks to receive their savings at as small a rate of interest as 2 per cent.

POWER OF THE FARMERS' NEW CAPITAL.

Farmers are using their new capital to abolish the waste places of the land. The river is leveed and alluvial bottoms subject to overflow become worth hundreds of dollars per acre for vegetables; a marsh is drained by ditches and tiles and celery makes it the most valuable land in the county; semiarid land is constantly cultivated so as to make a mulch of finely pulverized earth on the surface, and the crops that it will grow make the farmer prosperous; durum wheat or alfalfa is introduced and again the semiarid wastes are made to do the will of the cultivator; leguminous plants give humus and nitrogen to the sandy waste, to the use and profit of the farmer; the unused rocky, stony field or mountain side, offensive both to the economic and to the esthetic eye, blossoms with the apple, the peach, the pear, and the plum, and adds to the evidences that every square foot of the land may be made productive unless it is arid; and even then irrigation works, as far as water is available, swell the evidence. Along all of these lines of production farmers are using their newly acquired capital and are progressing as never before in their prosperity.

Formerly there was an abundance of farm labor and a dearth of farming capital; now these conditions are reversed and labor is scarce and capital abundant. Notwithstanding the farmers' inability to do some things for want of labor, the new situation is a great improvement upon the old one. The farmer can now employ every labor-saving device and thus reduce both the labor and the cost of production; he can raise his land to a higher state of fertility than can be made by chemical fertilizers alone, because he can advance the needed capital for permanent soil improvement and is in a position to await results; he can produce things that require years for the first crop, as in the case of fruits; he can provide such capital as is needed to distribute his products and thus cooperation is open to him to a greater extent than ever before; he can secure a better education for his children to the end, among other things, that they may do better with the old farm than he did.

PROMISING OUTLOOK.

The farmer's standard of living is rising higher and higher. The common things of his farm go to the city to become luxuries. He is becoming a traveler; and he has his telephone and his daily mail and newspaper. His life is healthful to body and sane to mind, and the noise and fever of the city have not become the craving of his nerves, nor his ideal of the everyday pleasures of life. A new dignity has come to agriculture, along with its economic strength; and the farmer has a new horizon far back of that of his prairie and his mountains, which is more promising than the sky-line of the city.

For the abundance that the Creator has sustained the farmer in supplying, for the stability of the national agriculture, and for the comforting prospect of a potent future, there are many evidences that the people are ready to join in a day of reverent and joyous Thanksgiving.

It is no little gratification to the head of this Department in presenting the foregoing picture of the farmer's place in the economy of the country and picturing the possibilities of his future to realize that this Department and its work have had an important share in the development which has culminated in the farmer's present prosperity, and that they are bound, if intelligently and generously administered, to play an important part in the future of American agriculture. With this thought in mind I will proceed to present for your consideration a review of the various channels through which the Department performs its important work and to place on record what has been done through them during the past year.

WEATHER BUREAU.

FORECASTS AND WARNINGS.

The Weather Bureau has issued warnings of dangerous gales on the Great Lakes and along the seacoasts, and has kept the great commercial and agricultural interests of the country as fully advised as possible of the coming of adverse weather conditions.

EXTENSION OF THE FIELD OF OBSERVATION.

Its field of observation is being gradually extended in the hope that a view of the atmospheric conditions which prevail over the great oceanic and continental areas will prove of especial value in making forecasts for this country. The two points from which advices of atmospheric changes are most desired at present are Siberia and the region in and about Bering Sea. It is hoped to obtain reports from Siberia through the courtesy of the Russian Meteorological Service. The laying of a cable by the United States Signal Service, connecting Alaska with this country, makes it feasible to secure much-desired weather reports from that part of the globe.

EXTENSION OF STORM-WARNING SERVICE TO VESSELS AT SEA.

During the year a plan has been perfected whereby vessels at sea equipped with wireless telegraphic apparatus may receive warnings of severe storms if within communicating distance of shore stations, or of other vessels which have received a warning.

OBSERVATORY BUILDINGS.

Five observatory buildings have been completed during the year, and one (the physical laboratory at Mount Weather, Va.) has been partially completed. The number of buildings of all classes now owned and occupied by the Weather Bureau is 41.

DISTRIBUTION OF FORECASTS THROUGH TELEPHONE EXCHANGES.

The number of telephone subscribers receiving the daily forecasts on June 30, 1905, was 464,738. This number was augmented during the year by over half a million, so that at the close of this fiscal year more than a million telephone subscribers were receiving the daily forecasts.

INVESTIGATION OF FROST CONDITIONS IN CRANBERRY DISTRICTS.

A special investigation has been carried on during a part of the year, having as its object the establishment of a scientific basis for accurate frost predictions in the cranberry regions of the country, especially in Wisconsin. The conditions of both soil and air which shortly precede and accompany frost have been studied closely, and valuable data have been secured.

INCREASE IN THE WEATHER SERVICE.

The utilities of the Weather Bureau are such that there is a constant and growing demand for an extension of the service so as to provide for telegraphing and publishing more meteorological data and establishing additional Weather Bureau stations. However, special effort is made to meet these demands with the existing appropriation, and no request that involves asking Congress for additional funds is honored except after a careful and thorough investigation of the necessities of the case.

There is already an extensive output of meteorological information that comes from the 183 full meteorological stations maintained by the Bureau and from several hundred stations reporting only temperature and rainfall. The daily output finds its way to the public mainly through the columns of the newspapers and in the maps and bulletins issued at Washington and outlying stations. Outside of Washington there are 105 stations which issue an aggregate of 25,000 weather maps daily, making a yearly issue of over 8,000,000 copies. The number of monthly climatological reports printed at 40 different section centers is 30,944, being an average of about 700 copies per month from each center; these contain the daily climatological features of various climatic districts. There is a constant demand from agricultural, commercial, and shipping interests for an additional amount of such data.

MOUNT WEATHER RESEARCH OBSERVATORY.

Progress has been made in the establishment of the Mount Weather Research Observatory. A station of the first order has been maintained throughout the year for taking and telegraphing reports that are useful in making forecasts.

In the preparation for kite and balloon work, a number of important instruments have been installed and made ready for systematic work. Observations of the upper air are now being regularly taken in concert with similar aerial research institutions in foreign countries.

The interior finishings of the magnetic observatory buildings, the erection of the piers, and the installation of the magnetic instruments were completed during the year, and automatic and other records are now being continuously made.

RECORDS OF EARTHQUAKES.

The attention drawn to scientific observation of earthquakes by the calamity that befell San Francisco on April 18, last, has prompted the Department to authorize the Weather Bureau to install an additional number of instruments at places of observation where the Department owns buildings and suitable ground. It is probable that during the coming year about 15 or 20 additional stations will be equipped with seismographs, so that the progress across our continent of earth vibrations can be more accurately measured and the data submitted for scientific discussion. These additional observations can be secured with only the expense involved in the purchase of instruments and their installation.

BUREAU OF ANIMAL INDUSTRY.

THE MEAT INSPECTION.

Meat inspection has been for several months a very live topic before the public. During the year the Federal meat inspection was conducted by the Bureau of Animal Industry at 163 establishments in 58 cities, and 42,901,284 animals were inspected at the time of slaughter, nearly all of them having also been previously inspected in stock yards. This represents the greatest amount of work done in any one year since the inspection was inaugurated in 1891. Of the animals inspected, 158,953 carcasses and 126,159 parts of carcasses were condemned for disease or other cause. The total cost of the meat inspection, including the microscopic inspection of pork for export to certain countries, was $852,561.70.

The importance of more thorough meat inspection and sanitation has been forcibly shown by the recent agitation and investigations relating to some of the packing-house methods. The new law which was designed to correct certain evils was passed by Congress June 30, 1906, and hence the work of the fiscal year under review was performed under former laws, which were, in many respects, defective and unsatisfactory. The act of March 3, 1891, as amended March 2, 1895, provided for the inspection of all live cattle intended for export or whose carcasses or products were intended for export; also for the mandatory ante-mortem inspection of cattle, sheep, and hogs, and the

additional permissive post-mortem inspection of their carcasses for interstate trade. It has never been possible, however, to apply the inspection to all the establishments coming within the law, since the appropriations have been insufficient for that purpose. Many establishments which desired inspection have had to be refused because of lack of funds to extend the service. Many that should have been compelled to have inspection were able to avoid it, as the former laws compelled inspection only in the case of export beef.

The law gave the Department no authority whatever to control the sanitation of abattoirs and packing houses, or to prevent adulteration or the use of chemicals and preservatives; nor was any authority given for following up meats which had once been inspected and passed immediately after slaughter, or for condemning any such meat which might afterwards have become unwholesome or unclean before or during the process of canning or packing or before being placed on the market. The inspection was therefore practically limited to the ante-mortem inspection of animals and the inspection of the carcasses immediately after slaughter. The meat found free from disease and otherwise wholesome at the time of this post-mortem inspection was properly marked, and that found diseased or unwholesome was destroyed. This inspection was efficient so far as it went, and it went as far as the law and the limited appropriations permitted. In its efforts to maintain an efficient inspection the Department sometimes even assumed authority not conferred by law, notably by requiring the destruction of condemned carcasses. In all the recent agitation the wholesomeness of the inspected fresh meat has not been seriously questioned. The disclosures of unsatisfactory conditions have related almost wholly to matters over which the Department had no legal control, such as the preparation of sausages, canned and cured meats, etc., the use of preservatives, and the insanitary condition and methods of the packing houses.

Realizing the shortcomings of the old law, the Department has several times in the past recommended the enactment of new legislation and the increase of appropriations for the extension and improvement of the service. Bills designed to remedy some of the defects were at different times introduced in Congress but failed to pass.

Even before the appearance of recent publications criticizing the insanitary conditions at the Chicago stock yards and packing houses, and reflecting upon the Federal meat-inspection service, steps had been taken to investigate these matters. A committee consisting of Dr. John R. Mohler, chief of the Pathological Division of the Bureau of Animal Industry, Dr. Rice P. Steddom, chief of the Inspection Division of that Bureau, and Mr. George P. McCabe, Solicitor of the Department, was sent to Chicago and made a thorough investigation. They made an exhaustive report, which was promptly transmitted to

the President and was afterwards by him laid before Congress. An independent investigation was also made under the President's direction by Messrs. Charles P. Neill and James B. Reynolds. Prompt and vigorous measures were taken to remedy the conditions disclosed by the reports of these committees, but it was realized that the Department could do very little under existing law and that the real remedy lay in new legislation backed by public sentiment.

Such new legislation was provided by Congress in the so-called meat-inspection amendment to the agricultural appropriation act of June 30, 1906. This law provides for a more thorough and comprehensive inspection system and makes a permanent annual appropriation of $3,000,000 to pay the cost of the inspection. With the greater authority now vested in the Secretary of Agriculture and with the largely increased appropriation, the service will be greatly extended in scope and in the number of establishments and quantity of product covered. The inspection will be extended as rapidly as possible to establishments engaged in interstate or foreign commerce and which come within the law. It will be applied not only to the live animals before slaughter and their carcasses at the time of slaughter, as heretofore, but also to the meats and meat food products in all the subsequent stages and processes of preparation, curing, canning, etc. Sanitary equipment, conditions, and methods will be required, the use of harmful chemicals and preservatives and of false and misleading labels will be prevented, and the transportation of meat in interstate and foreign commerce will be supervised and regulated. It is probable that it will be necessary to request Congress to appropriate an even larger sum to provide inspection for all establishments embraced within the law.

American live stock has long been considered the healthiest in the world. With our enlarged and improved inspection system, the stamp of the Government will be more than ever a mark of wholesomeness.

We must not imagine, however, that since the packing houses have been cleaned up and the inspection improved all the meat found in our local markets may be considered clean and wholesome. It must be borne in mind that the Federal jurisdiction is limited to interstate and foreign commerce, and that this inspection can legally be applied only to establishments doing an interstate or foreign business. To be sure, the Department insists on inspecting the entire output of each establishment at which its inspection is maintained, even though part of the product is to be consumed within the State; but the Federal inspection does not and can not reach the establishments doing business exclusively within a State. The Department, under the new law, can and will enforce cleanliness and sanitation in the establishments doing an interstate and export business, but it is powerless to reach the local houses. The latter must be looked after by the State and municipal authorities. Each State or community must protect itself against

unwholesome meats originating within the State. In the absence of an efficient local inspection the consumer's only safety lies in seeing that meat bears the Government label.

INSPECTION OF EXPORT ANIMALS.

The export trade in live animals is fostered by the inspection conducted by the Bureau of Animal Industry. During the fiscal year more than 1,000,000 inspections were made before exportation, and over half a million animals were again inspected on arrival at British ports by Bureau inspectors stationed there. Seven hundred and forty-nine inspections of vessels carrying export animals were made before clearance, and they were required to conform to certain regulations as to space, fittings, attendants, feed, water, ventilation, etc. The percentage of animals lost in transit was less than one-quarter of 1 per cent.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

Our domestic live stock is protected from the contagion of destructive diseases which exist in other parts of the world by a rigid system of inspection and quarantine of imported animals. In this service during the year 168,600 animals were inspected, and 1,898 of these were quarantined.

The quarantine stations on the Atlantic seaboard, with one exception, are in satisfactory condition. The station near Baltimore will soon have to be abandoned because of the dilapidated condition of the buildings and the building up of that locality. When a suitable location is secured an appropriation by Congress for the equipment of the new station will be necessary.

CONTROL OF CONTAGIOUS DISEASES.

The work for the control and eradication of contagious diseases of live stock in our own country has been attended with encouraging results. Sheep scab and cattle mange, which a few years ago had spread over the greater part of the Western States, are gradually yielding to our efforts. It is believed that their complete eradication will be only a matter of a few years. During the year sheep scab has been greatly diminished in Arizona and Idaho, and practically stamped out in Utah and Wyoming. Even more rapid progress has been made with cattle mange. Washington and Oregon, and large portions of Kansas, Colorado, Wyoming, Texas, New Mexico, and Oklahoma, have been freed from this disease and released from quarantine, and it is expected that the same will soon be true of extensive areas in North Dakota and South Dakota and other portions of Wyoming and Texas.

Maladie du coït, or dourine, an insidious venereal disease of horses, which existed in portions of South Dakota, Nebraska, and Iowa, is now believed to have been eradicated, after several years of vigilant work. Out of 965 inspections during the year no positive cases and but 3 suspicious cases were found.

ERADICATION OF THE TEXAS-FEVER TICK.

Under the provisions of the act of Congress approved June 30, 1906, appropriating $82,500 to enable the Secretary of Agriculture to undertake experimental work in cooperation with State authorities in eradicating the ticks transmitting Southern cattle fever, the Department has for some months past been assisting the States and Territories from California to Virginia along these lines. Anticipating the action of Congress an investigation was made respecting the laws of the various States, and through the various attorneys-general inquiry was made relative to the existence of State laws under which the Government could undertake the work of tick eradication. It was found that, while some State laws afford ample provisions, other States either have no law bearing on the subject, or the statutes are inadequate. The table following shows the particular points covered by the investigation and the general trend of the information received.

Provisions of State laws relating to quarantine, disinfection, etc.

State.	Questions and answers.			
	Are local officers authorized and empowered to enter premises to inspect live stock and enforce quarantine, including counties, districts, farms, and ranches, and to control the movement of live stock?	Are such officers empowered to enforce such disinfection of animals and premises as may be necessary?	Are State officials authorized to issue rules and regulations establishing and maintaining quarantine lines?	May the State confer authority upon Federal representatives to act as officials of the State in such matters?
Alabama	No live-stock quarantine or sanitary law.			
Arkansas	Peace officers may enforce quarantine lines fixed by law and by the United States.	No	No	
California	Yes	Impliedly	Yes	As county officials only.
Florida	No live-stock quarantine or sanitary law.			
Georgia	Yes; impliedly so	Yes	Yes	Not prevented.
Indian Territory	No law to cover these matters.			
Kentucky	Yes	Yes	Yes	Yes.
Louisiana	Yes; impliedly so	Yes	Yes	No.
Mississippi	No live-stock quarantine or sanitary law.			
Missouri	No	No	No	No.
North Carolina	Yes	No	Yes	Yes.
Oklahoma	Yes	Yes	Yes	Yes.
South Carolina	No law to cover these matters.			
Tennessee	Yes	Yes	Yes	Not prevented.
Texas	Yes	Yes	Yes	No.
Virginia	Yes	Yes	Yes	Yes.

The matter was early taken up with the proper officials in the States and Territories interested and arrangements were made for the Department to cooperate with them to the extent that their respective laws would permit. Under these arrangements the work has been done in close cooperation with the local authorities, who were permitted to designate the counties or localities to be covered and to recommend for appointment as agents of the Department men acquainted with the local conditions in the respective localities.

The territory in which it was desired to operate was divided into five sections, as follows:

1. California.
2. Texas, Oklahoma, Missouri, Arkansas, and Louisiana.
3. Kentucky, Tennessee, Alabama, and Mississippi.
4. Georgia and South Carolina.
5. Virginia and North Carolina.

The work was organized as soon as possible after the passage of the law, but it was late in July before it could be begun at all, and even later before it could be taken up in some sections.

As the conditions in the different sections were widely divergent, the plans of procedure and methods employed necessarily varied greatly. In some States meetings were held at which the subject of tick eradication was discussed with farmers, stockmen, and other interested citizens. These meetings were intended to be largely educational, but they gave an opportunity to petition State authorities for relief and to express preference for local inspectors, thus developing an enthusiasm and interest that can only come from a close personal identification with an enterprise of this sort. In some places it was necessary to employ inspectors who could live in the saddle and wield a lasso like a cowboy. These men worked in groups of about a dozen, each group having a cook and a camping outfit. They covered their territory systematically, roping and examining cattle wherever found, and informing the owners of infested animals of the most practical method of getting rid of the ticks. It was found advisable to buy a carload of crude petroleum (in barrels) for use in the treatment of infested animals. This oil was distributed and used under the immediate supervision of inspectors of the Department in the southeastern States, and was doubtless the means of doing what could have been done in no other way, as the crude oil is difficult to obtain in small quantities and at points far distant from its production.

The table following shows by States the number of herds inspected, the number of cattle inspected, the number found free of ticks, and the number found to be infested—the grand total of inspections being 29,315 herds containing 522,529 cattle.

Results of inspection work to October 31, 1906.

State.	Inspections.				Number of counties.
	Herds.	Cattle.			
		Free.	Infected.	Total.	
Alabama	780	4	5,550	5,554	2
Arkansas	1,527	6,671	2,332	9,003	2
California	1,015	67,517	58,589	126,106	11
Georgia	4,474	10,053	6,365	16,418	7
Kentucky [a]	4,077	13,653	7,332	20,985	4
Missouri	126	3,000	1,430	4,430	3
North Carolina					
Oklahoma	10,589	97,860	16,972	114,832	5
Tennessee [b]	6,317	23,204	15,840	39,044	17
Texas	410	86,682	99,175	185,857	17
Virginia					
Total	29,315	308,644	213,885	522,529	68

[a] In addition, in Kentucky 1,396 herds and 6,904 cattle were reinspected.
[b] In addition, in Tennessee 822 herds and 4,174 cattle were reinspected.

The work is still progressing in some States, but will be practically discontinued about December 1 on account of the lack of funds. The outlook for next season's operations in the different infested sections is very encouraging, and the work should be resumed in the early spring.

In considering the work done and the results attained thus far it should be borne in mind that the season was well advanced before the law was passed, and that, although some steps were taken in anticipation of its passage, yet the actual plans and organization for the work were late in formation. It should also be remembered that the amount appropriated was only intended to be used to inaugurate the work, and yet, as set forth above, employees of the Department have inspected 29,315 herds, containing 522,529 cattle, and have, in connection with local authorities, so attended to their disinfection and to the supervision thereof that forty whole counties and parts of eleven other counties, with an aggregate area of almost 50,000 square miles, will probably be released from quarantine before the end of this fiscal year. This is an area larger than that of the entire State of Virginia. Plans are laid and specific work is outlined for resumption in the early spring. The State officers, cattle owners, and others affected are intensely interested; educational work will be carried on, and there is every reason to believe that, with proper funds at the disposal of the Department next season, large inroads may be made into the territory now quarantined, and hundreds of thousands of cattle be given an unrestricted market, thus giving direct results to an immense number of people. This will stimulate interest in those States in which active interest is now lacking and will doubtless result in a more general movement against the cattle tick.

If the Congress at its next session will appropriate $250,000 for extending these operations and will continue to adequately sustain

them, and the States interested will do their part in the way of enacting favorable laws and appropriating money to be used in this cooperative work, it is only a question of time when the southern cattle tick in this country will be a thing of the past.

SCIENTIFIC INVESTIGATION OF DISEASES.

The scientific investigations of contagious diseases by the Bureau of Animal Industry have yielded results of especial importance with regard to tuberculosis and hog cholera during the past year.

TUBERCULOSIS.

The increasing and alarming frequency of tuberculosis in hogs, as observed in the meat-inspection service during recent years, led to experiments to determine the most probable source of infection of these animals. The practical conclusions of these investigations are that the most frequent causes of tuberculosis in hogs are to be found in the common practices of allowing these animals to follow cattle in the feed lot and of feeding them on skimmed milk or separator refuse. The feces of tuberculous cattle have been found to be heavily charged with tubercle bacilli. The experiments indicate that animals with tuberculous lungs, while they do not expectorate after coughing up tuberculous material, nevertheless scatter the bacilli freely by swallowing them, having them pass through their intestines, and discharging them with their feces. Hogs readily contract tuberculosis from eating the excrement of tuberculous cattle. For milk to be infected with tubercle bacilli it is not necessary that the udder should be diseased; infected feces are believed to be a common cause of contamination of milk drawn in the environment of tuberculous cows. Thus it seems that a single diseased cow may be the means of infecting the milk of an entire herd.

Other experiments showed that the location of lesions in the bodies of animals affected with tuberculosis is no guide to the mode or channel of infection. For instance, lesions in the lungs have usually heretofore been regarded as indicating that the infection was acquired by inhalation. The incorrectness of this view was shown by producing lung disease by inoculating hogs in the tip of the tail and by feeding them with tuberculous material.

These results emphasize anew the great importance of every farmer keeping his herd free from tuberculosis.

Experiments in the application of the tuberculin test to hogs showed that when proper precautions are taken tuberculin is about as accurate in detecting tuberculosis in hogs as in the case of cattle. The test was found reliable in 97 per cent of the infected experimental animals.

HOG CHOLERA.

Hog cholera has long been a cause of heavy loss to the farmers, and for years scientists in the Department and in various parts of the world have been working on the problem of the cause and prevention of this disease. Recent work of the Bureau of Animal Industry has demonstrated that the contagion consists of a virus which exists in the blood and other fluids of diseased animals, but which can pass through the finest filter, is invisible under the microscope, and therefore can not be isolated or discerned by any of the usual methods. This important discovery, which has since been confirmed by eminent scientific authorities in England and on the Continent of Europe, affords an explanation of the failure of past efforts to produce a satisfactory vaccine.

The real cause of the disease having at last been determined, the Bureau has during the past season conducted experiments with a view to producing a vaccine or serum which will prevent or cure the disease. Successful results have already been obtained in an experimental way, and efforts are now being made to adapt the method to practical and general use. The method has been patented by the Department in the name of the scientist who evolved it, Dr. Marion Dorset, the patent having been taken out in such a manner as to insure to all the people in the United States the right to its use free of royalty.

PARASITES OF SHEEP.

The stomach worm or twisted wireworm of sheep, a parasite causing great damage to flocks in many parts of the United States, has been studied, and the principal facts in its life history, which have hitherto been unknown, have been worked out. The eggs of the parasite are scattered over the pastures in the droppings of infested sheep or cattle. The embryos, which in a certain stage are enveloped in a sheath which enables them to withstand freezing and dryness, climb up blades of grass. When infested grass is eaten by a sheep the embryos continue their development in that animal. Experiments now in progress indicate that with certain precautions it is entirely feasible to raise lambs free from this and some other troublesome parasites.

BLACKLEG VACCINE.

The Department has continued to supply blackleg vaccine free of charge to stock owners, and reports indicate that the prevalence of this disease is gradually being reduced. During the year 1,350,915 doses of this vaccine were prepared and distributed. The losses among animals treated with this vaccine during the previous year were less than one-half of 1 per cent.

PEDIGREE ASSOCIATIONS.

After consultation with officers of American pedigree record associations, the Department has radically changed the regulations regarding the importation of animals for breeding purposes. Hitherto certificates of approved domestic and foreign associations have been accepted with the requirement that they should show the ancestors for two generations. This requirement caused inconvenience and dissatisfaction to importers, but the Department felt that unless it could supervise more closely the books of record such a requirement was necessary to give a reasonable assurance of pure breeding. The new regulations simply require that animals imported for breeding purposes shall be registered in an approved American book of record in order to be entitled to free entry. Where a breed has no book of record in the United States the certificate of the Chief of the Bureau of Animal Industry must be obtained. The records of the approved associations are closely supervised by the Department and must conform to prescribed conditions in order to remain on the approved list. This change should prove beneficial to the breeding industry. It will not only make officers more careful in the management of pedigree registers, but will practically compel the registration of imported pure-bred animals in American books.

HORSE-BREEDING INVESTIGATIONS.

Satisfactory progress is being made in the experiments in breeding heavy harness horses at the Colorado Experiment Station. The stud has been increased by the purchase of two Kentucky mares of desirable strains of breeding. It is considered advisable to increase further the number of experimental animals, and the Department should be prepared to purchase exceptionally good mares as opportunity offers. This line of experiments promises to be of the greatest value to American stockmen and should be carried out systematically and thoroughly.

Experiments have been begun, in cooperation with the Vermont Experiment Station, in breeding Morgan horses with the object of preventing the loss of the Morgan blood, preserving the type, and increasing the size. Seven mares and two fillies were purchased in Vermont and two mares in Kentucky for these experiments.

FECUNDITY OF SOWS.

Some unexpected but instructive results were obtained by a study of the fecundity of Poland-China sows. It had been supposed that this breed of hogs was declining in fecundity, and the Department was urged to undertake experiments with a view to overcoming this tendency. An investigation into the pedigree records and a comparison of two periods of years, based upon nearly 55,000 litters, showed

that the average number of pigs per litter was 7.04 during the years 1882–1886, and 7.52 during 1898–1902. There was thus an increase of 0.48 per litter instead of a decrease. These results led to a similar investigation of the Duroc-Jersey breed, and while the popular supposition that this breed is more prolific than the Poland-China was confirmed, it appeared that the average size of litters of Duroc-Jerseys had remained practically stationary for several years, the figures being 9.22 for 1893–1897 and 9.27 for 1898–1902. These investigations are being followed with studies of the inheritance of fecundity.

POULTRY BREEDING.

Investigations, with a view to developing a strain of chickens with increased egg-laying capacity, are being conducted in cooperation with the Maine Experiment Station. Several hens have been found to lay more than 200 eggs in one year, and the results seem to indicate that by selecting the best layers for breeding purposes and by proper feeding the average egg yield of a flock can be increased. The great benefit of such an increase is too obvious to require comment.

EXPERIMENTS IN ANIMAL NUTRITION.

A careful scientific study of the fundamental principles of animal nutrition by means of a respiration calorimeter has been in progress for several years at the Pennsylvania Experiment Station by cooperation between the Department and that station, and some important and valuable results have been realized. Beginning with the food as a source of energy to the animal machine, the investigators follow this energy through to its ultimate effect, determining how much escapes in the undigested residues of the food, how much is expended in the digestion and assimilation of the food, and what surplus remains to sustain the life of the animal or to enable it to produce meat, milk, or work.

The results thus far published include experiments with timothy hay, red clover hay, and corn meal, and they have shown that the so-called "fuel value" of feeding stuffs can not be taken as a measure of their nutritive value. The experiments have amply demonstrated that the real nutritive values of stock feeds are much less than their fuel values, the former ranging from 56 to 67 per cent of the latter in the particular feeds used. Experiments to study the effect of age and breed upon the percentage of food energy utilized have not been concluded.

FEEDING COTTON-SEED PRODUCTS TO HOGS.

The Bureau of Animal Industry has conducted experiments during the year to test the harmful properties of cotton seed and cotton-seed meal when fed to hogs. These substances proved fatal to the hogs, the time required to cause death being longer when a varied ration was

fed than when only one kind of grain was fed in addition to the cotton-seed meal. The results obtained by experiment stations as to the fatal effects of cotton-seed products in combination with corn meal were confirmed, but it appears from the Department's experiments that bran and middlings, instead of neutralizing the injurious effect of the cotton seed, as had been concluded from experiment station work, gave results very little better than corn meal. The experiments with bran and middlings will be repeated and other tests made. Chemical and pathological studies are being made with a view to discovering the cause of the harmful effects of cotton seed when fed to hogs.

THE DAIRY INDUSTRY.

The work of the Dairy Division of the Bureau of Animal Industry has been considerably extended during the year. Results of a valuable and practical nature to the dairy industry have been obtained from investigations in the manufacture and storage of butter and cheese and the production and delivery of market milk; and a good beginning has been made in the work for the improvement and development of dairying in the South and the investigations and studies regarding the construction of dairy buildings and the organization and management of dairy enterprises.

BUTTER INVESTIGATIONS.

About 5,000 pounds of butter were made under different conditions and stored for eight months at different temperatures. The conclusion from this experiment is that the use of cream received at the creamery in a sweet condition, light salting of the butter, and low temperatures (10° F. below zero to 10° F. above zero) give much the best results for storage butter.

Two common troubles of butter makers—mold in butter tubs and the fishy flavor of butter—have been studied. The coating of tubs with paraffin has been found to be an effective method of preventing mold. Investigations regarding the fishy flavor have not progressed far enough to determine the cause of this trouble and are being continued.

A system of market inspection of butter at New York and Chicago has been started with a view to assisting creameries to improve the quality of their product. When butter arriving at one of these markets is found deficient in quality a statement of its condition is sent to the butter maker, to the dealer who purchases the butter, and to the dairy and food commissioner of the State in which the butter was produced.

CHEESE INVESTIGATIONS.

Further work was done during the year in the manufacture and storage of cheese. A quantity of American Cheddar style cheese was

made, cured, and stored under varying conditions, and the details of the experiments, with a review of previous work on the subject, were published. The cheese that scored highest was that placed in storage at 32° F. directly from the press, while that scoring lowest was cured entirely in the factory curing-room at about 65° F. Cold curing appears to derive its value chiefly from its effect on what otherwise might be poor cheese. The popular taste is growing decidedly toward mild cheese, and to meet this demand it seems desirable to have cheese ripened, so far as it is ripened at all, at low temperatures.

The experiments in the manufacture of soft cheese of leading European varieties have been continued throughout the year in cooperation with the Storrs (Conn.) Experiment Station. During the winter a scientist connected with this work spent two months in Europe studying the manufacture of cheese, and these studies have resulted in marked progress in our investigations regarding Camembert and Roquefort cheese. While there are some problems yet to be investigated, the knowledge so far gained of the fungi, methods, and conditions necessary in the production of these kinds of cheese indicates that it is entirely practicable to manufacture in this country soft cheeses of these types fully equal to the best European product.

THE PRODUCTION AND HANDLING OF MILK.

Probably no article of food is more generally consumed than milk, and in striving for pure foods a wholesome milk supply must be considered of prime importance. During the year the Dairy Division has investigated the milk supplies of various cities, and has begun studies of the organization and working of milk sanitary commissions and other bodies whose object is to improve the quality of market milk.

The competitive exhibit of milk and cream at the National Dairy Show in Chicago in February was in charge of the Dairy Division and gave an object lesson of great educational value. It was demonstrated that milk and cream produced under sanitary conditions could be shipped long distances and kept sweet for several weeks without any other means of preservation than cleanliness and low temperatures.

DAIRY IMPROVEMENT IN THE SOUTH.

A careful survey of dairy conditions in the South has been made as the first step in the work of improving these conditions and promoting the dairy interests of that section. This preliminary work has shown that while in some cases southern dairy herds are yielding as good results as are ordinarily expected in any part of the country, there is great need throughout the South for education in improved methods of dairy breeding and feeding and milk production. Many of the southern people show a desire to learn more of dairying so as to get away

from the one-crop system. One serious handicap is the inferior class of cattle found there, probably due largely to the presence of the cattle tick.

OTHER DAIRY WORK.

To meet the demand for information and assistance as to the construction of dairy buildings, some studies and experiments have been and are being made. A circular giving plans for an improved dairy barn was published, and many plans for dairy buildings of various kinds have been worked out and sent to farmers throughout the country. Some experiments have been made in building silos of three types of construction.

Investigations into the organization, equipment, and management of creameries and cheese factories have been undertaken to enable the Department to give advice and assistance on these subjects.

RENOVATED BUTTER.

In the administration of the portion of the law of May 9, 1902, which relates to renovated butter, the Department has continued its supervision of the manufacture and sale of this article. The factories and ingredients are inspected to insure sanitary conditions and wholesomeness, and the product is inspected in the markets with a view to detecting and preventing violations of the law and regulations as to proper labeling. The factories are in better sanitary condition than in past years, and as a rule the manufacturers show a disposition to comply with the law and regulations. Evidence of the illegal sale of renovated butter by dealers in several cities has been collected, however, and some prosecutions have been instituted. The regulations of the Department have been sustained in two court decisions.

BUREAU OF PLANT INDUSTRY.

A leading feature of the work of the Bureau of Plant Industry during the past year has been the cooperative demonstration work with farmers, fruit growers, and others. It has been my established policy to have our own officers carefully scrutinize all operations, including those which involve the conducting of business as well as those in which both field and scientific investigations are concerned.

INTRODUCING NEW CROPS AND NEW INDUSTRIES.

The search by agricultural explorers in foreign lands for new crops has been continued. A trained man has spent the last year in the cultivated fields and wild mountains of north China and Manchuria searching for new plants and seeds worthy to be transplanted to this country and for wild forms of our cultivated fruits and vegetables which may have characters of hardiness or unusual vigor that will

make them useful for the plant breeders of the United States. Shipments of scions and of seeds representing hundreds of interesting things have been sent in and are now growing in the trial gardens of the Department. Among the things secured are new hardy Pekin persimmon varieties, interesting varieties of the English walnut, the Chinese pistache, wild and cultivated apricots, the wild peach from its supposed original home, hardy apples and edible-fruited hawthorns, millets and field beans, a lawn sedge that is promising, and a very remarkable lot of Chinese grape varieties, not to mention a most unusually interesting collection of ornamental trees and shrubs suited to the climate of the Eastern and Middle States.

New alfalfas and other crops.—One of the most important achievements of the Bureau's exploration work is the recent discovery by Prof. N. E. Hansen, of the South Dakota Agricultural Experiment Station, who is now abroad in the interest of the Department, of the existence of a Siberian alfalfa, an excellent forage plant with yellow instead of the usual blue flowers. This plant is native on the dry steppes of Siberia, where the mercury sometimes freezes without snow, thus proving the ability of the plant to withstand with no protection a temperature of about 40 degrees below zero. The existence of this alfalfa has been suspected for many years, and its final discovery, it is believed, may mark an epoch in the agriculture of the northwestern prairie regions of the United States, where the rainfall is slight and the winters are exceedingly cold. Professor Hansen is making a very careful study of this plant, with a view to its cultivation in this country. A quantity of the seed of this valuable crop has been secured, which will be given a thorough trial by the Department at an early date. It will supplement durum wheat in a rotative system and avoid the necessity of summer fallowing.

The most distinct of any of the alfalfas is the newly introduced Arabian, characterized by its large leaflets, hairiness, and vigorous growth. Its quick recovery after cutting renders an extra cutting possible in long seasons. It is proving of special value in the irrigated sections of California and the Southwest, though its lack of hardiness makes it unsuited to the colder parts of the country. Attempts are under way to establish strains resistant to cold and drought.

A species of vetch called the Tangier pea has proved superior to all others in California in its luxuriance of growth, having yielded as high as 9 tons of green feed per acre. On account of this great amount of herbage it chokes out weeds very effectually. As a green manure crop it promises in California to supersede all others. Its value as forage remains to be ascertained. A large quantity of seed is being grown so as to introduce it extensively next season.

A most luxuriant subtropical grass, called the Para grass, has proved well adapted to the Gulf coast region, Arizona, and California. Where

sufficient moisture is provided this grass will yield about 8 tons of hay per acre. It is coarse in quality, but very nutritious. The seed is very poor in quality, but the grass can readily be grown from cuttings, one plant covering 100 square feet or more in a season. It is planned to distribute the cuttings extensively in the spring of 1907.

ENCOURAGING THE MATTING INDUSTRY.—The United States imports every year larger and larger quantities of hand-made floor coverings made from several species of aquatic rushes and sedges that grow pretty generally over the world. In 1906 more than 50,000,000 yards were imported, and more than $4,000,000 paid for them, notwithstanding the fact that looms have been invented that can weave the rushes into useful floor mats. These looms, the result of American ingenuity, when tended by single operators, can turn out more than 30 yards of matting a day—a strong contrast to the hand looms in use in foreign countries from which we draw our supplies of matting. The common rushes of our neglected swamp lands and tidal regions can be made into matting, but these lack the delicate, slender character of the cultivated forms in use in the Orient, India, and Africa. Our explorers have been gathering living plants of the best foreign varieties, as well as selecting the most promising native types for trial plantings in the abandoned rice plantations of the Carolinas and for the delta regions of the Mississippi and Rio Grande, where cheap lands, which are not now growing profitable crops, are awaiting for a new plant culture.

A NEW SUBTROPICAL FRUIT.—The Florida fruit growers have had their enthusiasm aroused this year by the ripening of several of the delicious, fiberless East Indian mangoes which the Department has introduced. The collection is one of the largest in the world, and Florida growers are waiting to see the behavior of the different sorts now under trial before planting large areas in this fruit, without doubt one of the great fruits of the world.

SUCCESSFUL DATE CULTURE.—The date palms introduced by the Department into southern California and Arizona have borne hundreds of pounds of delicious fruit this year. Even the famous Deglet Noor from the Sahara has ripened perfectly in the Salton Basin, proving that this unique desert culture has passed from the stage of a pure experiment into that of a new industry.

THE PISTACHE NUT.—The investigation of the pistache, a promising dry-land nut crop, has resulted in a distinct widening of the possibilities of its culture through the introduction from Turkestan of hardy forms. Three wild species suitable for stocks have been introduced from the driest deserts of the Old World, and a very hardy stock has also been secured in northern China.

INVESTIGATIONS BY THE PATHOLOGISTS.

The year has been an unusual one in the field of plant pathology. There have been serious outbreaks of disease and the staff of men engaged in this work has been kept very busy.

PEAR BLIGHT.—The Department has worked out by careful bacteriological investigation methods of controlling this serious menace to the pear and apple industry. The disastrous attacks of the old eastern pear blight upon the magnificent pear orchards of California have brought into prominence the importance of this work. During the past six years the Department has been engaged in demonstrating on a small scale in certain isolated orchards the practicability of controlling the disease, mainly by the eradication of the blighted portions of the tree and the antiseptic treatment of the wounds. Strenuous efforts are being made by the Department, in cooperation with the State experiment station and the State and county horticultural commissioners of California, to assist in applying these methods in saving the California orchards. The pear orchards of California represent a valuation of about $15,000,000, producing an average annual income to the fruit growers of $1,500,000. One-third of this, at least, has already been destroyed, but we hope to help the growers to save the remainder. Pear blight is destroying the pear industry in several other western States, and urgent requests have been made for assistance, which the Department expects to grant as far as it is able.

LITTLE PEACH AND PEACH YELLOWS.—The little peach disease has now been kept under control for three years on the test area in Michigan, and it is believed that the efficacy of the method has been fully demonstrated there. Work has therefore been transferred to a similar demonstration, in cooperation with the Cornell Experiment Station, in a test area in Niagara County, N. Y. This is confidently expected to show the possibility of greatly reducing the ravages of the little peach disease and also of the peach yellows.

Peach yellows has been unusually destructive in West Virginia and Maryland during the past season. Department experts have been studying the disease in cooperation with the West Virginia State Experiment Station and urging the application of eradication methods. In one district, at least, in West Virginia, fully 90 per cent of the peach trees have been destroyed by the yellows during the past three years, and mainly during the present season.

APPLE BITTER ROT IN THE OZARK MOUNTAIN REGION.—Last season's successful spraying experiments in Virginia demonstrated for the first time the possibility of controlling bitter rot of the apple on the Yellow Newtown variety and indicated the exact dates of treatment. This work has now been transferred to the Ozark districts of Missouri and Arkansas. Here it has been tested on a much larger

scale and on different varieties of apples. The results fully corroborate last year's conclusions and have demonstrated the entire feasibility of practically complete control of this serious orchard disease. Some minor rots and defects of the apple have also been more completely brought under control as a result of this treatment.

Gumming fungus or shot-hole fungus of the peach.—The gumming fungus or shot-hole fungus has been increasing in California at an alarming rate during the last five or six years and has resulted in very severe losses to the peach growers of that State. It threatens the destruction of the peach industry of the Sacramento and San Joaquin valleys. A treatment was suggested, after proper study by Department officials, which has been wholly successful.

Wilt-resistant melons.—Wilt has nearly destroyed the watermelon industry in many sections of the South. All known varieties of melons have been tested, but none resistant to the disease was found. It was found, however, that the citron is resistant, and the Department undertook by hybridization to breed this quality into the melon. The result has been successful, and there has been secured and fixed a variety of melon very resistant to wilt—a heavy yielder, of excellent quality, and well adapted to shipping. Next season it will be propagated for distribution.

Wilt-resistant cotton.—The wilt-resistant selections of Sea Island cottons are now regularly used in the infected soils in the Sea Island districts of South Carolina. The loss from wilt has thus been practically eliminated in the principal region in which this special cotton is grown. The disease is still causing much loss in the interior districts, where this variety of cotton is grown, owing to the fact that many of the growers do not appreciate the value of resistant seed. Demonstration tests, however, are rapidly convincing them. Excellent wilt-resistant selections of Upland varieties have also been secured. Seed will be distributed this year to cooperators and propagated next year for more general distribution.

Disease-resistant potatoes.—For several years this Department has been testing various American and European varieties of potatoes, especially for disease resistance, and has now secured several good varieties resistant to both the early and late blight, as well as to tipburn and flea beetles. The work is carried on principally in cooperation with the Vermont Experiment Station, though several other States are also cooperating.

PROGRESS IN CEREAL WORK.

Extension of the winter wheat area.—About four years ago the Department began a systematic distribution of the Kharkof wheat, and extensive trials of this variety in cooperation with the State experiment stations. It is the hardiest winter wheat yet grown in this

country, and is now thoroughly established. By its use the area in which winter wheat can be successfully cultivated has been much extended to the northward and westward, particularly in Nebraska and Iowa, while a considerable amount is now grown in South Dakota and southern Minnesota. It will be conservative to state that wherever this wheat has been introduced the yield per acre is being increased on an average of 5 bushels.

ESTABLISHMENT OF WINTER BARLEY.—Much attention has been given this year to the introduction and development of winter varieties of barley. It is well known that fall-sown grain will yield much more on the same ground than spring-sown grain, in addition to the fact that winter grain is almost always of better quality. Excepting some Southern States, winter barley has heretofore been practically unknown in this country. After three years of demonstration work, the Tennessee Winter barley is now well established in Kansas, Oklahoma, and southern Nebraska, in addition to a few successful trials that have been made in the North Central States. The results of the introduction of this barley are remarkable and very interesting. Wherever it has been grown it is now often yielding 50 per cent more to the acre than the ordinary spring barley. Besides, it has the advantage of giving much winter pasturage in seasons that are favorable for pasturing.

The unusual success of some of our introduced Swedish and Austrian pedigreed barleys is opening up the great possibilities of pure strains of this cereal, especially for malting purposes.

DURUM WHEAT.—In the field work on durum wheat all efforts are now being concentrated on its improvement, particularly in the development first of pure types. Much help is being given in the investigations of this wheat by the experiment stations, particularly those of North Dakota, South Dakota, and Colorado. It is so well demonstrated that the Kubanka variety is the best, considering all qualities, for the northern districts that farmers everywhere throughout the North are urged to sow only this type. A number of experiments, including baking tests, all of which have been published, have proved conclusively that it is equal to the best No. 1 hard spring wheat for making bread. The results in the sale of this wheat during the last season and so far this season have been favorable far beyond expectation. Last year about 10,000,000 bushels were exported to foreign countries, and the price on an export basis at New York City and on the Canadian border was at several times equal to that of the hard spring wheat. Probably at least 20,000,000 bushels were produced in 1905, which, after making ample allowance for seed, leaves several million bushels that must have been used for bread in this country. A good portion of this was used in Minneapolis. For the crop this year a

safe estimate would be about 50,000,000 bushels, or approximately one-twelfth of the usual wheat crop of this country.

From the daily and weekly reports received from the markets, it appears that about 12,000,000 bushels of this crop have so far been sold for export. This season, at New York City, durum wheat is so far selling uniformly at 5 or 6 cents less than the same grade of Manitoba hard. The increasing export demand from dealers who know how to judge this class of wheat ought to be strong evidence of its value to American manufacturers, and it is hoped that in the future our home consumption will increase much more rapidly.

Sixty Day oat.—In previous reports attention has been called to the superiority of the introduced Swedish Select oat over other standard varieties throughout the Northern States. During the same time another variety of oats has been introduced from Russia, known as the Sixty Day, but which matures, however, in a little over ninety instead of sixty days. It is so much earlier than other varieties that it often escapes many fungous and insect pests that attack other oats, as well as the effects of severe periods of drought. It is very prolific as a rule, and has an unusually wide adaptation geographically.

Amarillo testing farm.—The testing farm at Amarillo, Tex., has been in operation one year, and the fall seeding of the second year is now finished. The operations here are to a large extent in the nature of pioneer work to demonstrate to the inhabitants of the large area of the Panhandle of Texas that agriculture can actually be conducted in that region. The experiments were conducted previously at Channing, Tex. That much success has been attained in this work is indicated in the many crops that have been successfully grown throughout that territory during the last year, the farmers having been induced to sow these crops largely through the influence of these investigations.

Investigations in California and the Southwest.—Experiments for the purpose of improving the quality of wheat in California have been conducted for two years at Modesto and Yuba City, Cal. In addition, seed of some of the most promising varieties of wheat used in these experiments has been furnished in cooperative trials with farmers in other States of the Southwest. From the results of the work so far it is evident that at least two of these new wheats are very well adapted to the southwestern United States and are at the same time good milling wheats.

Chemical and baking tests of flour and grain.—In cooperation with the Bureau of Chemistry many chemical analyses and other tests have been made of introduced grains, particularly oats and barleys, to determine their feeding value. An important piece of work has been the investigations of the comparative value of durum-wheat flour for bread making conducted for this Department by the Columbus Laboratories of Chicago.

A STUDY OF WHEAT DETERIORATION.—During the year a special investigation, also in cooperation with the Bureau of Chemistry, has been made to determine the causes of the deterioration of wheat from the milling standpoint. An important clue to the solution of this problem has been discovered, and when the matter is fully worked out it will, without doubt, enable the farmer to prevent the production of soft and light-colored grains that are much inferior in quality.

RICE INVESTIGATIONS.—A series of experiments for the thorough study of rice, its varieties, methods of handling, irrigation, etc., has been inaugurated in cooperation with the Louisiana Agricultural Experiment Station, Crowley, La., having been selected as the place of operations. More than 300 distinct varieties of rice are under experiment. The results of this season already show that a good beginning has been made in this work.

GRAIN STANDARDIZATION.

From time to time during the past five years demands have been made upon the Department for aid in the grading and handling of grain. It has been fully recognized that this is a matter which demands most careful investigation, as both our home and foreign markets are involved. Grain grading as now practiced by the various State and other organized bodies has not been satisfactory, chiefly on account of the lack of uniformity. The Department has consistently held the ground that some system of standardization is absolutely necessary as a first step toward securing uniform methods of grain grading. With a view to eventually bringing about this standardization, Congress at its last session authorized the establishment of laboratories for the purpose of examining and reporting upon the nature, quality, and condition of any sample, parcel, or consignment of seed or grain entering into interstate or foreign commerce. After a careful study of the situation, two laboratories, all the funds at hand would permit, have been established—one at Baltimore, Md., the other at New Orleans, La. At both places the Department has received the cordial cooperation of the chambers of commerce, and is now about to enter upon the regular duties connected with the laboratories.

It will be the object of these laboratories to make a thorough study of present systems of grain grading with a view to reaching, if practicable, conclusions which will make standardization possible. It is recognized that much preliminary work must be done, and, furthermore, that special apparatus will have to be devised for quickly determining the moisture content of grain, and for conducting other observations and investigations. A moisture-determining apparatus has already been devised and is now in use at our laboratories. It is believed that improvements can be made in these devices and the Department's officers are already at work on this problem.

Recognizing the need for the closest relations with the grain trade, the Department has secured the services of an expert in grain grading, whose long experience should be of the greatest value in working out the many problems which must necessarily be connected with this important line of work.

DRY-LAND FARMING.

Recognizing the necessity for more systematic efforts along the line of dry-land farming, during the past year important field and laboratory investigations have been arranged for, which, it is believed, will be of great value to those who have already settled or who contemplate settling in semiarid areas where irrigation is impracticable. The Great Plains area, lying between the ninety-eighth and one hundred and fourth meridians and including approximately 330,000 square miles, is one of the most important districts where this work is being conducted.

Scope of the investigations.—Throughout this vast area there is not a single State experiment station, although there are several substations. The plan of the work is to establish special substations in cooperation with the State experiment stations in North Dakota, South Dakota, Nebraska, Oklahoma, Colorado, Kansas, and Texas. At these stations a series of tests will be carried on which will enable the State authorities and the Department to answer definitely important questions as to systems of cropping and farm management in this extended area. The successful work already inaugurated with the durum wheats leads to the belief that there are several other crops which might also prove highly successful.

Advice to prospective settlers.—On account of the efforts made by land agents for the past two or three years to induce farmers to take up land in this region it seems proper to make a few cautionary statements in regard to this entire section of country. While there are great agricultural possibilities in the region, the fact must not be overlooked that farming there must be conducted along radically different lines from those of the more humid portions of the United States. Unquestionably many settlers have gone into this section who will be grievously disappointed in the near future. In spite of the fact that the past few seasons have given abundant rainfalls, the evidence is pretty conclusive that conditions will soon resume their normal state, which is one of semiaridity, and these conditions must be met in a way for which few farmers of the section are now prepared. It is needful to look with great caution upon the statements emanating from interested parties as to the probability of continued rainfalls and the growing of crops similar to those now commonly known to the more eastern sections of the United States.

GOOD SEED FOR THE FARMER.

Several lines of work carried on during the year have for their object the improvement of the seed upon which the farmer must depend for his crops. The investigations of seed adulterations previously mentioned in these reports have been continued, and there is every evidence that the publication of the names of firms found to be selling adulterated seed has been the means of checking the evil. In all this work the Department has but one object, namely, to protect the farmer from unscrupulous dealers who make a practice of foisting bad seed upon him. The rank and file of American seedsmen do not follow any such practices and are as anxious as the Department to protect the farmer.

A CAMPAIGN OF EDUCATION.—The Seed Laboratory has tested for both seedsmen and farmers hundreds of samples of seeds during the past year, and in this way has greatly encouraged the propaganda for good seed. A feature of the work has been a campaign of education for better seed. Cheap seed is often the most expensive thing connected with a crop. A few cents saved on each pound of alfalfa or clover seed may cost the farmer all of his work in preparing and fertilizing the ground, besides the loss of an entire season in getting the crop started. The Bureau has also been actively engaged in encouraging the good-seed work through addresses at farmers' institutes and other meetings.

BETTER GRADES OF SEED CORN.—Special work has been done during the past year in demonstrating the great importance of high-grade seed corn. The work was inaugurated to establish the great value of proper care of the ordinary seed as grown by the farmer. The main point at issue was the gain in yield due to the vitality of the seed. Actual field demonstrations have shown that, taking corn in the average—that is, corn from different parts of the United States as ordinarily saved for seed by farmers—the yield would be increased about 15 per cent if the vitality were perfect. The Department has pointed out simple methods of testing vitality that any farmer can follow, and has shown in field practice that the adoption of such methods by the farmer may increase his yield from 10 to 15 per cent. Similar work has been conducted with a number of other crops.

WORK ON THE SUGAR BEET.

PRODUCTION OF HIGH GRADE STRAINS OF SEED.—The work on breeding high-grade strains of sugar-beet seed has been very satisfactory during the year. This work is being conducted in cooperation with a number of experiment stations and private individuals. The first commercial crop of seed raised from roots selected under departmental supervision was harvested this year by a grower in Washington State and some 15,000 pounds of seed were secured, all from beets which,

commercially analyzed by the Department, showed sugar contents of 21 to 22 per cent. In the work of selection rigid attention is given to every detail of size, color, form of root, shape of leaf, etc. The Department has received from a number of sources satisfactory evidence that the American seed which it is developing is highly satisfactory. One factory alone reports that the American-grown seed increased the yield 1.19 tons per acre on an area covering 391 acres, divided among 158 farmers. This seed was put out in competition with some of the most expensive grades of imported seed obtainable. As a line of work closely connected with the foregoing, the Department is carefully investigating and testing various varieties of sugar-beet seed imported, together with all strains of sugar-beet seed grown by American firms.

Single-germ seed.—Very satisfactory results have been secured in the development of a sugar-beet seed which will contain a single germ. It is highly important to secure beet seed which will eliminate a considerable portion of the work of thinning. The latest returns from our investigations along this line show that our beets are averaging about 26 per cent of single-germ seed and that such seed is producing beets yielding from 16 to 17 per cent sugar. The purity coefficient is also found to be satisfactory.

The important work on fertilizers, the improvement of cultural conditions, and the extension of the sugar-beet area has been continued.

FRUIT MARKETING, TRANSPORTATION, AND STORAGE INVESTIGATIONS.

Experimental investigations of the methods of harvesting, packing, transporting, and storing fresh fruits of various kinds have been continued during the year. The fruit transportation studies have been confined chiefly to questions involved in the transcontinental shipment of deciduous and citrus fruits of the Pacific coast to eastern markets.

Shipments of peaches and plums.—Experimental carload shipments of perishable varieties of peaches and plums, which were allowed to remain on the trees in California until they reached much fuller ripeness than has previously been considered safe by shippers, disclosed the fact that such fruit can be delivered in eastern markets in practically as sound condition as when taken from the tree. The superiority in flavor and wholesomeness of such sound, ripe fruit as compared with fruit either overripe and decayed or prematurely picked and wilted, which makes up so large a portion of the commercial supply of our cities, was clearly apparent. Special treatment of these experimental shipments consisted simply in the quick cooling of the packed fruit from the high temperatures which it possessed when picked from the tree to a temperature of 40° to 50° F. before it was loaded in ordinary iced cars for shipment. Carloads of fruit thus treated not

only required less ice in transit, but maintained more uniform temperatures in the top and bottom of the car, with resultant greater uniformity of condition of contents when unloaded.

Experiments in citrus fruit transportation.—Along similar lines, but with closer attention to methods of harvesting and manipulating the fruit, a careful study of orange-handling methods in southern California was made. This revealed many interesting and important facts. It was found that the difference in the carrying quality of oranges from different producing districts in southern California was due primarily to the methods of handling practiced rather than to inherent characteristics of the fruit itself. Oranges free from mechanical injuries, inflicted during the various processes of harvesting, rarely showed decay during the ordinary shipment period, even when transported without icing. On the contrary, similar fruit which had suffered from inconspicuous cuts or abrasions of the skin developed from 25 to 75 per cent of decay under similar conditions. A comprehensive series of experiments, in which fruit treated by different methods was subjected to conditions favorable to the development of decay, showed that where unmutilated fruit as it came from the tree developed but 1.5 per cent of decay, similar fruit, when dry brushed, showed 4.5 per cent, and washed fruit 10.5 per cent. The whole trend of the results of the investigation thus far indicates that complexity of methods and appliances in the handling of oranges results in increased mechanical injury and correspondingly heavy losses from decay in transit.

A study of the transportation of oranges across the continent, in which different methods of shipment were compared, showed that where oranges that had been mechanically injured were shipped under ventilation, 14 per cent of decay developed. Similar fruit shipped under ordinary icing developed 7 per cent of decay, while fruit that was precooled and shipped in iced cars developed but 4 per cent. Studies of the effect of holding the packed fruit before shipment showed that, on the average, fruit shipped the first day after packing developed but 2 per cent of decay; that shipped the third day, 3.5 per cent; the fifth, 8.6 per cent, and the seventh day, 9.5 per cent. The proportion of decay developed in the mechanically injured fruit included in the above experiments was very much above these general averages, the important fact developed being that prompt shipment after packing greatly reduces the risk in transit.

Results of fruit transportation work.—These investigations have had the active support of growers, shippers, and transportation interests. In the citrus industry advantage is being taken of the results of the work. Packing houses are being remodeled and simplified, the fruit is being shipped more quickly after picking. All the

interests involved have shown a disposition to take advantage of the facts developed in the investigations. One of the prominent shipping interests of the Pacific coast has estimated that the work of the Bureau along this line saved the growers at least $250,000 in the season of 1905-6.

STUDIES OF FRUIT STORAGE.—In the fruit-storage investigations the cooperative study of the effect of sod and tillage on the keeping of apples has been continued with the New York State Agricultural Experiment Station, and special studies in relation to temperatures have been made in the East. The apple-storage investigations have been extended to Pacific coast fruit, considerable quantities of apples from different California apple districts having been stored in that State and in the East for comparison. Special attention has been given to farm storage-house questions.

EXPORT SHIPMENTS OF FRUITS.—In the fruit-marketing investigations the experimental export shipment of summer apples from Delaware was continued, and similar shipments also of winter varieties from New York and Virginia. The problems connected with the exportation of winter apples to European countries are recognized as of the highest importance in this connection and are being studied as thoroughly as the conditions render practicable. The importance of the apple export trade to our domestic fruit industry is shown by the fact that while the crop of 1905 was estimated to be the smallest during the past decade, the portion exported was but 7 per cent less than the average of the previous five years, constituting, as nearly as can be estimated, more than 5 per cent of the estimated total crop. Fuller information as to conditions prevailing in ocean transportation and in foreign markets is greatly needed.

The exportation of eastern-grown "Bartlett" and other early pears, which began with the Department experiments in 1901, shows a gratifying increase, the total exports of pears during the fiscal year being valued at $691,972, the larger part of which exports were of eastern-grown fruit. The beneficial effect of this export movement of pears was very evident in our markets, where good prices prevailed in consequence.

DEVELOPING NEW CROPS BY BREEDING AND SELECTION.

The Bureau's work in developing, by breeding and selection, new types of various crops has been very successful during the past year. A number of new sorts have been secured, some of which have been placed with growers and are now being grown on a large scale.

NEW CITRUS FRUITS.—The production of the new group of fruits, the citranges, or hardy oranges, is one of the most far-reaching and important triumphs which has ever been achieved as a result of carefully planned breeding experiments. Three varieties—the Rusk, Wil-

lits, and Morton—have already been named, and trees have been distributed to about 2,000 fruit growers and nurserymen, principally in the Gulf States and in Oregon and Washington. Two other new varieties have been produced, having large fruits similar in appearance to ordinary oranges, and these will be named and distributed in the near future. Both of these varieties are somewhat different from the sorts previously named, and are believed to possess superior merits in certain characters. Both are large, fine-appearing acid fruits, and are very juicy. They will prove valuable, especially for culinary purposes and in the making of acid drinks. Another variety has been secured which has fairly good fruits, and gives promise of utility as a hedge plant and lawn tree. The citranges are of special value for cultivation in regions slightly too cold for the ordinary orange, and can be recommended for planting throughout the Gulf States and in regions of low altitude in Oregon, Washington, Arizona, and New Mexico.

New pineapple varieties.—Three of the new varieties of hybrid pineapples have this year been distributed to a number of good growers, and next year stock of all of the new varieties developed by the Department will be available for distribution. The further experiments in this field have resulted in the discovery of six more new hybrids which possess qualities that will render them valuable for cultivation. These will be placed with growers at the earliest possible date. All of the new varieties of pineapples are superior in flavor to the ordinary varieties, and many of them have smooth or spineless leaves, a quality of considerable value to the grower. All pineapple growers who have had an opportunity to examine and test these hybrids are impressed with their superior quality and promise.

A new early variety of cotton.—It has been claimed by entomologists and others studying the control of the cotton boll weevil that varieties of cotton are needed which will mature their entire product very early in the season, in order to permit the crop to be harvested and the stalks destroyed early in the fall. A new early defoliate variety has been produced by an agent of the Department, working in cooperation with the Texas Agricultural Experiment Station, which possesses these qualities in marked degree and which, at the same time, is a productive sort having fairly large bolls. This new variety, the present season, ripened its fruit and matured earlier than any other of the varieties tested in comparison with it, among them being the King, which is probably the earliest variety cultivated. The new variety gives promise of being of great value for planting in boll-weevil infested regions. Several other varieties of cotton selected to secure earliness and productiveness, fitting them for boll-weevil conditions, have been under experimentation, and select seed of two of these sorts, the Edson and Triumph, will be distributed this winter.

New strains of corn.—In the corn-breeding experiments great advances have been made. One variety, which has been carefully bred in central Ohio, has, for the last four years, shown an average yearly gain of 10 bushels per acre over the original variety. Seed of this variety has been sent to numerous farmers and is giving excellent results. The breeding work with sweet corn, having as its object the improvement of strains for canning purposes, has been continued with good success. It has been demonstrated that an excellent quality of sweet corn seed can be grown, and that with good care it will germinate much better and produce a better crop than such seed as is customarily purchased by canning companies.

Improvement of oats.—The most promising features of the oat-breeding work are the new hybrids recently developed. These are large grained and early in season, and retain the vigor and size of the late-season parent. They bid fair to excel and eventually succeed all the early varieties now grown in the central Mississippi region. Selections for disease resistance have also been made, and the year's experiments have proved that it is possible to secure smut-resistant varieties. One selection of the Burt variety has proved to be almost smut proof.

Crops resistant to alkali and drought.—The testing of different varieties of the leading field crops with regard to their alkali resistance is being continued and extended. Much information that will permit of a choice of crop plants and plant varieties for alkali lands and provide a solid basis for the increase of resistance by breeding has been obtained. The field investigations of crop plants in relation to alkali are being supplemented by extensive laboratory experiments. As a part of the investigations of the Bureau in dry-land agriculture, the breeding of drought-resistant strains of important field crops has been taken up in cooperation with some of the State experiment stations.

PROGRESS IN TOBACCO WORK.

The tobacco-breeding experiments have proved particularly successful, and several of the new sorts produced in the course of the Department's experiments have already been planted extensively by tobacco growers, and are giving excellent results in increased yields of a superior grade of tobacco.

Connecticut wrapper tobaccos.—In the work of improving Connecticut wrapper tobaccos two new hybrids have been produced—the Brewer and the Cooley. The Brewer is a hybrid of the native Connecticut Broadleaf with the imported Cuban, while the Cooley is a hybrid of the native Connecticut Havana Seed variety with the Imported Sumatra. In the hybrids the good qualities, hardiness, and adaptability to Connecticut conditions of the native varieties are combined with the superior wrapper qualities of the imported Cuban and

Sumatra. The product of the hybrids has superior qualities for cigar-wrapper purposes, possessing characters which go to make up a valuable wrapper tobacco. Numerous growers have been pleased with the superior grade of tobacco produced by these hybrids and are this year growing a considerable quantity of the new varieties and selecting seed to extend their planting next year.

WRAPPER AND FILLER TOBACCOS IN THE SOUTH.—The experiments conducted in Florida in the improvement of tobacco varieties have demonstrated the value of this work to growers. Carefully selected strains of Sumatra have clearly shown their superiority, both in quality and yielding capacity, to the ordinary Sumatra-grown. The crops grown from select seed furnished by the Department to 12 different planters are far superior to the remainder of their crops and are decidedly the best crops of tobacco in the State. As a result of this demonstration of the value of the methods of selection and preservation of seed worked out by the Department of Agriculture, almost all of the large tobacco growers are this year using similar methods, and more than 50,000 paper bags have been used during the past summer by growers in covering the flower clusters of their select seed plants.

MARYLAND SMOKING TOBACCOS.—Experiments in the improvement of the Maryland smoking tobaccos have been carried on during the year in cooperation with the Maryland Agricultural Experiment Station. Selections made to secure greater uniformity and increased yields have shown striking results. The fields of tobacco grown from select seed are believed to be the best tobacco grown in the State the present season.

MISCELLANEOUS TOBACCO WORK.—One of the most important features of the tobacco-breeding investigations is the development of methods by which the grade and quality of the tobacco produced can be accurately determined. During the last year an apparatus has been devised for testing the burn of cigars accurately and another for testing the burn of strips of leaves. These machines will prove of great value in connection with the breeding experiments and probably also in the commercial testing of samples of wrapper tobacco. Investigations of the curing of tobacco have been undertaken, directed more especially toward the control of pole burn by means of artificial heat. Several diseases of tobacco are receiving attention, and the breeding of varieties for disease resistance gives promise of good results.

EXTENSION OF EXPERIMENTS.—The tobacco-breeding experiments are being extended to the tobacco-producing areas of Kentucky, Ohio, and Virginia, and it is probable that results can be obtained in these regions as important as those produced in Connecticut and Florida. The introduction of the methods of seed selection and seed separation alone in these extensive tobacco-producing States will add many thousands of dollars to the value of the crop grown.

DRUG AND POISONOUS PLANT INVESTIGATIONS.

Work on camphor.—Rapid progress has been made in the investigation of camphor production, a number of camphor trees of various ages having been placed at the disposal of the Department for experimental work. More than 30 pounds of camphor were prepared, which on purification gave very favorable results. Tests of a scientific nature showed the identity of this product with that of the Orient. A careful survey of the camphor trees now widely scattered throughout Florida, and of the conditions of soil, drainage, etc., in which they occur, has made it seem reasonably clear that camphor will flourish over a large part of the area from which frost has driven the orange industry.

Studies of poisonous plants.—In the poisonous-plant investigations chief attention has been given during the year to the poisonous action of the so-called loco weeds in causing the loco disease in horses and cattle. The general outcome of this work has shown very clearly that these weeds are able to produce the symptoms characteristic of locoism and are unquestionably the chief cause of the immense loss to the stock-grazing interests of the West. Remedial measures are now being sought, as are also means of exterminating the weeds and methods of counteracting the poison.

PROGRESS IN GROWING AMERICAN TEA.

The work in South Carolina for the purpose of determining the possibilities of the commercial production of tea in the United States has progressed satisfactorily during the year. The younger gardens have given an increased yield, due in part to a change in the method of picking which was tested during the year. As a result of all influences the greatest yield during the history of the experiments was obtained, something over 12,000 pounds of dry tea. In the factory some new machinery was tested. The compression of finely ground tea into tablets was attempted with a machine of the same general type as that used by manufacturing chemists, the result being that after a few trials a hard, sightly tablet was produced which readily dissolves in hot water. The superior adaptability of this form of preparation for purposes where compactness is desired is apparent. In addition to the work in South Carolina a tea garden has been established at Pierce, Tex. The work at this point gives promise of very satisfactory results.

IMPROVEMENTS IN DISTRIBUTING NITROGEN-FIXING BACTERIA.

The method of distributing cultures dried on cotton for the inoculation of leguminous crops was discontinued during the year, and in its place the plan adopted of distributing pure liquid cultures hermetically sealed in glass tubes. This has been proved to be a great

improvement over the old system. It is planned to distribute during the current year larger cultures to the farmers, and thus render it possible to reduce the time formerly required to develop a rich culture for inoculating leguminous crops. Many field tests in this work are under way on large farms, and it is hoped by this careful experimental work to acquire much valuable information concerning the best manner of treatment of certain soils and crops in order to obtain successful inoculations.

WORK ON WATER CONTAMINATION.

The work of the Bureau of Plant Industry in the treatment of water supplies with copper sulphate for the destruction of algæ and pathogenic bacteria has passed from the experimental stage to that of actual practical use. Investigations of the use of copper sulphate in sewage disposal have indicated that in small sewage plants the use of copper will make it possible to produce sewage effluents that are entirely free from pathogenic bacteria. Work is being planned to test the efficiency of copper in connection with filtration. Additional work is to be carried on throughout the United States in order to determine the value of copper in various types of water. The copper treatment of water supplies, sewage disposal, etc., should in all cases be supervised by an expert. Before this method of purification is attempted the conditions must be worked out on a scientific basis in each instance.

FARM-MANAGEMENT INVESTIGATIONS.

The farm-management investigations during the past year have been carried on along two principal lines, namely, the study of farm practice and demonstrations in improved methods. The object of the first is to make a careful study of farm methods as followed by successful men in different sections of the country and representing different types of agriculture. These studies lead to the securing of data which enable the Department to assist farmers and others in planning methods of cropping and maintaining soil fertility. In connection with this work special attention has been given to crops adapted to new sections and to the relation between certain improved crops and soil fertility. Alfalfa has been found to be adapted to an important soil formation in Alabama and Mississippi, and is rapidly becoming a valuable crop of that section. This soil is heavily charged with lime. In this connection the Bureau of Plant Industry follows closely the work of the Bureau of Soils in its soil mapping. A special study has been made during the year of the practices of farmers in the East who have been successful in growing alfalfa.

Methods of storing silage.—In connection with the studies of farm practice, a special investigation has been made during the year

of methods of storing silage. The kinds of crops used for silage, the cost of growing and of siloing them have all been considered.

CONTROL OF JOHNSON GRASS.—The farm-management investigations also deal with the question of weed control. It is believed that data have been secured which will enable the farmer to control Johnson grass and utilize it in a satisfactory way in crop rotation in the South. The secret of success in this work lies in the fact that in a Johnson grass sod left undisturbed for two or three years the rootstocks are found only at the surface. In this condition the pest is easily destroyed by shallow plowing and a little extra cultivation the next summer. This permits Johnson grass to be grown in a rotation, such as cotton, corn and cowpeas, winter oats, and Johnson grass for two years. Where the pest is allowed to grow on land that is cultivated in cotton or corn the rootstocks penetrate deeply into the soil and eradication is extremely difficult.

CACTUS-FEEDING EXPERIMENTS.—Investigations into the value of cactus as food for cattle have been continued. A carload of steers were fattened on cactus and cotton-seed meal, at a cost of 3½ cents per pound of gain. As a feed for dairy cows 6 pounds of fresh cactus equaled 1 pound of sorghum hay when fed with a mixture of grain and mill stuff.

OBJECT-LESSON FARMS.—The object-lesson farms referred to in former reports have been continued. As the result of the work on one of these farms, many farmers in Alabama have sown alfalfa and are thus preparing for the advent of the boll weevil. The great advantage of pasturing hogs on alfalfa in that section has been demonstrated. In order to meet the demand for object-lesson farms in the South the system of establishing these farms has been changed. Instead of assuming close supervision of the farms, working plans are now prepared. This enables the Department to reach many more localities than were possible under the former system.

Nearly all successful farms are unique in their management. They represent systems wrought out by men of unusual energy and intelligence who have gone resolutely about discovering and utilizing the full possibilities of their land. From such men we are learning facts which when properly classified will constitute the art of farm management. These farms demonstrate the great value of intelligent management, as compared with hard work applied unintelligently.

SPECIAL WORK ON COTTON.

The special work on cotton which has for its object the meeting of the ravages of the boll weevil in the South has been continued along pretty nearly the same lines set forth in my last report. The cooperative work with farmers has been a special feature and has been extended into Louisiana, Mississippi, and Arkansas. This work is

now carried on in the States mentioned, and in addition special attention has been devoted to Texas, which is in the heart of the boll-weevil infested territory. Experience has enabled the Bureau of Plant Industry to systematize the work so as to reach practical farmers and secure their interest and cooperation. It is estimated that through this work the Department is now reaching, directly and indirectly, in the neighborhood of 100,000 farmers in the States mentioned.

The plan is a simple one, and from its very simplicity is found to be effective. Meetings of farmers are held in different communities and arrangements made whereby representative men agree to handle a part or all of their land with the advice and assistance of the Department's agents. No radical recommendations are made in the matter of changing the existing systems, unless such systems are known to be bad. The varieties of cotton known to be best adapted for boll-weevil conditions are recommended and planted. Systems of fertilization are suggested and, wherever practicable, diversification is encouraged. The farmers who are cooperating with the Department in the work receive regular visits from our agents and, in addition, furnish weekly reports setting forth their operations and the results. At the end of the season there is, as a rule, a demonstration as to the effectiveness and value of the systems laid out as compared with the old methods. A special point which the Department makes in all this work is that no radically new methods are being urged. We simply endeavor to have put into practice methods which are already known to be highly successful, encouraging the farmer himself to take the leading part in the work.

The breeding work, having for its object the securing of types of cotton better adapted to boll-weevil conditions, has already been referred to under the head of plant-breeding investigations. As a part of this special work on cotton, investigations of root rot have been continued, the same being largely field studies to determine the value of crop rotations in eradicating the pest from the soil. Investigations of cottons found in Guatemala and other southern countries have also been continued and some interesting results secured. Some of these cottons give promise of proving valuable for use in connection with breeding work. Having developed for a long series of years in combat with the boll weevil, they have characteristics quite different from any types of cottons which we now possess.

DEPARTMENT GROUNDS AND ARLINGTON FARM.

The Department grounds, consisting of 40 acres, are now in a well-developed state. During the year all the roads have been improved, a special appropriation of $3,500 being used for the purpose. The glass houses on the grounds have been further improved and are now being used for many lines of work carried on by the Bureau.

At the Arlington Experimental Farm there are about 350 acres under cultivation. Many varied lines of work are being carried on, including the testing of foreign crops, variety tests of all seeds and plants sent out, cover crops for orchards, variety orchard and other fruit tests, etc. The farm now has a well-equipped range of glass houses for experimental work and all the newer portions of the land are being brought into good tilth by the use of proper management and green manures.

CONGRESSIONAL SEED DISTRIBUTION.

The Congressional seed work for the year has been conducted along practically the same lines as in the past. The number of packages of miscellaneous vegetable and flower seed sent out during the year was about 7,000,000. There has been no change in this number during the past five years.

FIELD LABORATORIES AND TESTING GARDENS.

At its Mississippi Valley laboratory, located at St. Louis, Mo., the Bureau of Plant Industry has conducted investigations of many of the diseases which affect forest and fruit trees in that region. Methods of treating fence posts have also been worked out during the year. Considerable attention has been given to the crown-gall disease of orchard and other fruits, with the object of finding a means for preventing the further spread of the disease. The results obtained have shown that the crown gall of the apple tree can be very largely prevented by careful attention to root grafting and by subsequent wrapping of the grafts with cloth, rubber, or paper. It has been found that this type of the disease is not contagious, while, on the other hand, the crown gall of the grape may be transmitted through the soil and may be spread by irrigation water from one vineyard to another. American varieties of grapes have been found to be very resistant to the disease, and the most probable method of its control will consist in the growing of resistant varieties. Further proof has been obtained as to the contagious nature of the crown-gall disease of stone fruits.

In the work on various diseases of forest trees, an investigation of the diseases of red gum has been continued at various points in the Mississippi Valley. The diseases of the living tree were investigated, particularly the form of rot which destroys thousands of feet of gum timber every year after it is cut. A large quantity of timber was given a treatment as a preliminary test to ascertain whether this destruction could be prevented. The treatment showed an increase of 20 per cent in the amount of lumber cut, meaning almost a total prevention. The methods of treatment worked out are being tried by lumbermen on a commercial scale.

At the Subtropical Laboratory, Miami, Fla., the Bureau is conducting investigations of the diseases affecting tropical and subtropical plants, such as the mango, avocado, and citrus fruits. Methods have been worked out for the control of these troubles. Experiments in the propagation of tropical and subtropical fruits are also being conducted at this laboratory.

The Bureau of Plant Industry is carrying on at its Plant Introduction Garden, located at Chico, Cal., experiments in the propagation of many seeds and plants introduced from foreign countries. Trials of forage crops and vegetables suited to the Southwest are also being conducted at this garden. Twelve acres at the garden have been set aside for experimental work on European grape varieties, 4,180 cuttings having been rooted during the past season. A number of these were distributed during the past spring among the experimental vineyards maintained by the Bureau in different parts of California. Experimental work in the propagation of figs and of the pistache nut is also being carried on at the garden and with growers in the Southwestern States.

In addition to the foregoing, the Bureau is conducting an experimental farm at San Antonio, Tex. The object of the work at this farm is to test new crops likely to prove of value to the region represented, and to find the best methods of tillage by which the relatively large but irregular rainfall of the region may be utilized in the profitable production of the staple crops.

FOREST SERVICE.

NATIONAL FOREST RESERVES.

The fiscal year 1905–6 was and will remain notable in the history of the Forest Service for the progress made in actually applying a National reserve policy. In area the reserves were increased during the year from 85,693,422 to 106,999,138 acres. In revenue the reserves brought in $767,219.96, as against $60,142.62 for the previous year and $58,436.19 for the year 1903–4. In timber sales there were disposed of for immediate or early removal nearly 300 million board feet of lumber at stumpage prices ranging up to $4 per thousand (besides other material to a large value), as against [illegible] board feet, with a maximum price of $2.50 per thousand in 1904–5, and 69,257,710 board feet in 1903–4. The number of free-use permits granted in the same years also showed progressive increase. In the year 1904–5 the reserves were under Forest Service control only after February 1.

One fiscal year of full control has established two important facts—that the reserves advance the present interests of the people of the West and that they will speedily pay the cost of administering them.

PUBLIC UTILITY OF THE RESERVES.

These National forests are being made useful now. The benefits which they are to secure are not deferred benefits. Through Government control the interests of the future are safeguarded, but not by sacrificing those of the present. Far from handicapping the development of the States in which they lie, the reserves will powerfully promote development. They work counter to the prosecution of no industry, and retard the beneficial use of no resource.

The wealth of the West lies, and will long lie, in what the soil will produce and in what the earth hides. Labor and capital will here find employment mainly in turning to use the farm land, grazing land, timber land, and mineral lands of the region, and in the commerce to which these great productive industries will give rise. That the reserves beneficially affect all of these industries is becoming clearer to the people of the West every day, and in consequence the policy of public administration of our unappropriated timber lands becomes more and more firmly established in the approval of a united public sentiment. Local sentiment has sometimes been unfavorable to the creation of reserves before their effect upon the public welfare was understood; but opposition has always dissolved under the test of actual experience.

The reserves do not withhold land from agricultural use, but greatly increase the amount of available farm land. Though they were made from the most rugged and mountainous parts of the West and were intended to include only land unsuited for agriculture, by the act of June 11, 1906, the right is given settlers to homestead within the reserves wherever strips and patches of tillable land can be found. At the same time, through their water-conserving power, these forests fix in regions of scanty rainfall the amount of land which can be brought under the plow, since at best much otherwise fertile land must go uncultivated for want of water. Without forest preservation much of the land now under irrigation would have to be abandoned again to the desert. Thus the promotion of agriculture is one of the main ends of the forest-reserve policy.

Mining in the West is mainly in regions surrounded by reserves or included within them; but the reserves do not impede the development of mineral resources. On the contrary, by guaranteeing future supplies of timber they are indispensable to the future development of these resources, as the great mining interests well know. They do not interfere with the prospector, who has the same right to prospect and locate in forest reserves that he has on any other part of the public domain.

Administrative control of the forest reserves is beneficial to the grazing industry. The sentiment of stockmen throughout the West is unitedly in favor of such control, because of the gain to them now

that the reserve ranges are safe from overcrowding and deterioration. Thus the rights of the individual user are respected and the permanence of this great resource is assured. I wish to commend particularly in this connection the heartiness and good spirit with which the associations of western stockmen have cooperated in our efforts to enforce fair and just measures for the regulation of grazing in the interest of all users of the forests, and in the interest of the public, to whom these forests belong. The charge of a grazing fee, made for the first time during the past year, though reasonable in view of the advantages of grazing regulation to the stockmen and the cost of reserve administration to the Government, and justly due in the interest of the public, might have been expected to cause dissatisfaction and friction. On the contrary, as soon as the reasons for the charge and the method in which it would be applied had been explained, it was generally approved and paid willingly and promptly. It was followed by no falling off in the number of stock grazed in the reserves. In some cases the associations of stockmen have voluntarily aided the Service in settling local difficulties. Their whole conduct has shown remarkable moderation, far-sightedness, and readiness to recognize and accept what is in the permanent interest of their industry, even though it involves the sacrifice of immediate personal advantage.

Finally, Forest Service administration of the reserves is beneficial alike to the lumber industry and to the timber-consuming public. There is now standing on the reserves not less than 300 billion board feet of merchantable timber. This is not locked up from present use as a hoarded supply against future needs; it is ready for the immediate demands of a developing country. It will not be rushed upon the wholesale market in competition with the cheap stumpage prices of private owners anxious for ready money, and it will not be disposed of under a short-sighted policy of utilization which would leave a gap between the end of the present supply and the oncoming of the second crop; but it is and will continue to be available, first for the small user—home-builder, rancher, or miner—and then for the needs of lumber concerns, large miners, and railroads, for which a timber supply is indispensable, and which in turn are indispensable to the prosperity of the West.

The supply of timber furnished by the matured crop now on the ground is so vast in proportion to the present demand that there might seem to be no need for caution in its use. Were no more cut than last year it would suffice for four hundred years. In the mature forest production is at a standstill, so that from the point of view of the largest possible production of timber lumbering under such methods as will insure a second crop is highly desirable. The demand upon the reserves, however, is as yet insignificant in proportion to even the present need, most of which is met by the supply from

private holdings. The reserves form the heart of the western timber lands. They are generally less accessible than the private holdings which surround them, and would naturally form the last resource of the lumberman. They must be so maintained as first of all to be ready to meet the future demands of the regions in which they lie. With a growing population and expanding industries these demands will far exceed those of the present. The crucial problem of management will be to insure a timber and water supply for the great West, and to conserve the summer stock ranges. To meet it successfully will require careful foresight and the best technical information. Timber sales are now made with strict attention to the welfare of the forest, and at stumpage prices often decidedly in advance of the market.

THE RESERVES SELF-SUSTAINING.

The income from the reserves is as yet but a small fraction of what may be expected as they approach full utilization. Yet their administration is already on a sound business basis. Not only are they meeting from their receipts a very large part of the cost of their maintenance; they are even now beginning to show a decided decrease in net expense to the Government. My estimate of the appropriation necessary to meet the general expenses of the Forest Service is less by $100,000 than the appropriation of last year, notwithstanding that the total area of the reserves has been substantially enlarged by Executive action, that increasing use necessitates greater expense of administration, and that in general the work of the Service is growing very rapidly. Though the administration of the reserves forms but a part of the field of work, it may confidently be expected that within five years from the transfer of the reserves to this Department the Forest Service will cost the taxpayer nothing whatever.

In reaching this result no unjust burden will have been laid on any interest. As public property the National forests should yield to the public a reasonable return for whatever of value private individuals secure from them for their own profit. In accordance with this principle, applicants for special privileges—as rights of way, reservoir sites, power-house sites, and similar concessions—have been called upon to pay for such privileges on the basis of their commercial value. For example, in the case of water powers duly located under the State laws, but which can not be developed without the occupancy of reserve land, besides a charge for the land occupied, based on its value as forest land, a small charge per unit of power developed is made, not for the use of the water itself, which is granted directly by the State, but for the conservation of the supply which the preservation of the forests furnishes, and which, were it not for the existence of the reserve, the water-right owner could secure only by himself acquiring great bodies of forest land. Such a charge is essentially similar

to the charge for stock grazed upon the reserves. It is a return for actual value received, and throws upon those who profit by public control of the reserves a share of the cost of maintaining that control.

By the wise and just provision of Congress in enacting at its last session that 10 per cent of the gross receipts from the National reserves shall be made over to the several States in which they are situated, for the benefit of the counties which would otherwise receive no revenue from a part of their area, a real grievance was redressed. Even with the present use of the reserves the benefits thus reaped from them by the communities in their neighborhood are of substantial importance. As time goes on the importance of this provision will increase, and eventually the counties will find themselves far better off than they would have been without the reserves, for private ownership followed by exploitation would have destroyed the sources of revenue by leaving little or nothing of permanent taxable value, whereas now every resource is conserved and will be made to pay its just share of income. Since the fundamental purpose for which reserves exist is to secure the best permanent use of all resources, their effect is to add to property value, and by turning over 10 per cent of their gross receipts to local use they will contribute far more to the local public needs than the taxes they would pay if they were private property.

Protection of the reserves from fire has been the most important task laid upon the Forest Service. It is cause for congratulation that the loss by fire during the year was so slight. Indeed, the saving which resulted from the organized care of the reserve force was undoubtedly worth more than the whole cost of administering the reserves. Only about eight fires of any consequence occurred on the reserves during the calendar year 1905, a season of extreme dryness and one in which under ordinary circumstances the damage from fires should have been unusually large. This small number was due in large part to the system of patrol, which leads to the discovery of fires before much damage has been done. So far during the calendar year 1906 the damage from fire has been extremely small, even in comparison with that in 1905. Increased efficiency of the patrol system, combined with favorable climatic conditions, has led to this favorable result.

WORK OF THE YEAR.

FOREST MANAGEMENT.

The progress made by the Forest Service in the brief period of seventeen months, during which it has had charge of the reserves, in introducing management upon a vast field of operations in virgin forests of varied types, compares favorably with anything that the history of forestry can show in any country. From Minnesota to southern California and from Washington to New Mexico, reserve

timber is now being cut under regulations looking to a second crop. With larger experience the methods now applied will doubtless be found faulty in some respects, and with opportunity for more intensive use which the rising value of timber will afford, much more satisfactory results will be possible; but the important fact is that, confronted with a problem of unexampled magnitude in its kind, the Forest Service proved able to substitute conservative for destructive use, while greatly increasing the use itself.

Live timber is cut on the reserves under stipulations based on actual study of the forest conditions to protect the forest and the water supply from injury. Piling of the waste left by logging is always required, a diameter limit is set to prevent too heavy cutting, seed trees are left where necessary to provide for reproduction, full utilization of all salable material is compelled, and young growth is protected from injury. All this the purchaser is under contract to perform, under the supervision of the forest officers, who are held to efficiency by systematic inspection. Yet in spite of these requirements, which slightly reduce the profits of lumbering to the purchaser, record stumpage prices have often been obtained, and the average price realized has been far above that usually paid in the same regions. Living trees to be cut are marked beforehand by the forest officers, who also scale the lumber before it is removed.

Though some large sales of timber have been made in regions where great quantities of mature forest were available and exposed to deterioration, the constant policy has been to encourage the small user. Besides the free-use permits, in more than 99 cases out of every 100 the sales were of less than 5 million board feet.

Receipts for the sale of timber on the reserves were nearly $250,000, while the contract sales of the year reach a total of over $500,000. Five years is the longest period allowed under these contracts in which to cut the timber sold. Timber which can be harvested with profit only by large operations and with a heavy outlay for the construction of a milling plant or means of transportation, or both, must necessarily be sold under a contract extending over several years; but no sales are made permitting the speculative holding of timber against a rise in market price.

The largest totals of sales by States were in South Dakota (73 million board feet), Wyoming (71 million feet), and Montana (over 53 million feet). In the latter two States heavy lodgepole pine forests are ready for the ax, but difficult to lumber from their inaccessibility. At the same time a sudden demand for lodgepole pine railroad ties has opened a market for this timber and made it possible to sell by large contracts under conditions which will permit a second cutting after thirty or forty years. In South Dakota a special reason exists for pressing the sale of timber with the utmost energy. By the ravages

of a bark beetle great quantities of timber are being destroyed, and the annihilation of the entire forest of the region is threatened. Only by extensive cutting of infested trees can the spread of the beetles be checked and the damaged timber be utilized.

In Colorado and Arizona sales of timber totaled over 27 million board feet for each State, and in Utah and California over 10 million. In Colorado and Utah these sales were mainly of fire-killed timber, largely used in mining. In Arizona large quantities of mature accessible timber permitted extensive cutting without injury to the forest. In other States cutting was comparatively insignificant in amount, save in Idaho, where nearly 9 million feet were cut.

Little difficulty was experienced in preventing timber trespass upon the reserves. Where such trespass occurred the full value of the timber taken was recovered. Practically no loss was sustained from theft.

COOPERATIVE MANAGEMENT.

The Forest Service continues to receive applications from private owners for assistance in introducing forest management upon their holdings. So far as possible the Forest Service will give aid in this work as in the past, since it is plainly in the public interest to promote the practice of forestry among private owners on business principles. It is significant that while at the first it was necessary to prepare a working plan for every timber tract before recommendations for conservative management could be made, during the past year, out of 54 timber tracts examined, it was possible on 43 to outline at once a system of management and the regulations to put it into effect. Working plans were made during the year for 6 large tracts in New York, Kentucky, Michigan, and South Carolina, and for 100 woodlots in 16 States.

In the woodlot work, which assists small owners, particularly farmers, to make the best use of their woodland, special attention was given to the Middle West. Very different problems are here presented from those of the Eastern States, hitherto the main field of woodlot study. As the need of timber becomes more pressing, the yield from these small forest areas, which nevertheless in the aggregate form a large part of our total woodland area, will become increasingly important. On the whole, the farmer knows how to utilize his woodland far less intelligently than any other part of his farm. If he can be brought to an early realization of the future value of good timber and knowledge of how to grow it, great benefit will result, both to the farmer and to the community, which later will stand in need of every available supply.

Cooperative forest studies were carried on during the year with the States of California, New Hampshire, and North Carolina; with the Office of Indian Affairs of the Department of the Interior, on the

Wisconsin Indian Reservation; with the War Department, on the military reservation in New Mexico; and with the Hydrographic Division of the United States Geological Survey, upon the Potomac River watershed. Tie production in Wisconsin and Minnesota, in cooperation with the Northern Pacific Railroad, and the effect of sulphur fumes from smelters on neighboring forests in Tennessee, in cooperation with private forest owners and with the Bureaus of Chemistry and Entomology, were also studied.

FOREST EXTENSION.

The field of forest planting in the United States broadens with every year. In the East the economic conditions are bringing rapidly nearer intensive forest management, which will involve extensive planting, both to stock the land fully and to shorten the interval between crops. In the Middle West the rising value of lumber is tending to make the growing of trees profitable on land now in pasture or under the plow. Knowledge gained by past investigations of how to make trees grow under adverse conditions opens enlarged possibilities to private owners in the more arid parts of the far West. By far the most important part of the field, however, is that of reserve planting. Here in the future a gigantic task will be presented, upon which the Forest Service has already begun a preliminary attack. Planting will furnish a future timber supply, improve drainage basins, and replace inferior species with more valuable trees. Of the 107,000,000 acres of reserves enormous areas are partly or wholly unforested.

In the Middle West alone are 5 reserves, aggregating over 750,000 acres, which are practically treeless and on which planting is now under way. Doubtless future additions to the reserves will still further increase the task. While some of this land may never support trees, the public welfare will eventually demand that the larger part of it be forested. Unaided natural reproduction can never accomplish the task in time. As the need for wood and water increases, planting on a scale as yet entirely unthought of in this or any other country will be carried on.

For private planting the two most serious obstacles to widespread activity are the high cost and the poor quality of both the nursery stock and the tree seeds now commercially obtainable. In some cases eastern tree planters have been compelled to import from Europe nursery stock of American trees, and adulterated seeds are common on the market. It is not possible for the Forest Service to supply nursery stock for private use, but it is doing what it can to aid the planter by tests of the purity and germinative powers of seeds furnished by different dealers, and by information as to prices at which seeds and stock may be obtained in different regions.

For planting on the reserves the Forest Service must raise its own material. Six planting stations are now established, with an annual capacity of 6,000,000 seedlings. Yet to plant 1 square mile requires more than 700,000 seedlings. Though four years have passed since the first nursery station was established, the work as yet done has been hardly more than experimental, and in the newer nurseries few of the seedlings are old enough to plant out. To meet the needs of the reserves, preparations for planting must be made on a vastly greater scale.

As a first step, nursery sites will be established at rangers' headquarters on all the reserves. As rapidly as possible the reserve force will be trained to carry on this work, and nursery stations will be multiplied.

The real progress made toward reserve planting appears not in the number of trees set out or the present capacity of the stations, but in the fact that practical methods of doing the work at reasonable cost have been found. In spite of the high cost of labor in this country, an acre of land can now under ordinary conditions be planted to forest by the Service almost as cheaply as the same work is done in Germany. The whole problem of successful forest planting under the conditions of aridity, elevation, lack of transportation facilities, and scarcity of labor, combined with the lack of any experience which could guide to right action, was one of extreme difficulty. Though much yet remains to be done before a perfected system of planting will have been secured, the work now done amounts to a demonstration that success is within reach. This in itself is no small achievement.

COOPERATIVE PLANTING.

The Forest Service cooperates with private owners to secure forest extension by preparing planting plans for them. Two years ago the average size of the planting plans made was 68 acres. Last year it was 310 acres. This is significant of changing conditions. Increasingly as the necessity of provision for the future needs becomes plain, large owners are seeking the cooperation of the Service. A number of railroads have begun to plan for tie production from planted timber; coal companies are preparing to utilize waste land, and cities are seeking to improve their watersheds and at the same time derive a revenue from the land held for watershed protection.

Examinations were made of over 300,000 acres on which the owners wish to consider planting, and detailed planting plans were made for over 10,000 acres in 19 States.

Cooperation with other Departments, by the preparation of planting plans, included the War Department, the Bureau of Fisheries of the Department of Commerce and Labor, and the Reclamation Service of the Department of the Interior.

DENDROLOGY.

The investigation of turpentining methods was pushed along lines which promise important economic results by diminishing the wound inflicted on the tree and greatly prolonging the period during which a tract may be worked. A chemical study of the turpentine from different species of pines (conducted in cooperation with the University of North Carolina) is under way to learn which species furnish the most valuable yield.

Studies of forest distribution and resources were continued. The experimental basket-willow holts demonstrated the success of the cultural methods advocated by the Service by producing a crop of rods of the finest quality. Analyses of willow barks established their value for use in tanning. By the identification of many samples of woods valuable information was furnished wood users.

FOREST PRODUCTS.

An important means of reducing the drain upon our forests is the treatment of wood by seasoning, by the use of chemicals, or by both combined, to make it last longer. Careful experiments are under way to determine the most effective and economical methods of treating railroad ties, telephone and telegraph poles and cross arms, and fence posts. Material cut at different times of the year, seasoned at different times of the year, and by different methods, and treated by different processes is being tested in service to find out how it can be made most durable.

Wood distillation to utilize the waste product of lumbering, and the suitability of untried woods for making paper pulp, were made the subjects of special studies.

Over 12,000 tests of the strength of timber were made. The woods tested include loblolly pine, red fir, western hemlock, Norway pine, tamarack, white and red oak, and eucalyptus. By these tests, which show the suitability of the various kinds of wood for different uses, both timber-land owners and those who employ wood in building and manufacturing have received great benefit. New woods have been brought into use and economy in the use of material has been promoted. The present facilities for this work are inadequate, and it is important that a special laboratory be provided at Washington.

By statistical study of the production and consumption of lumber in various forms and compilation of the various grading rules now in use, information greatly desired by the lumber trade but never before obtainable was gathered, better conditions were promoted, and light was thrown on the highly important question of the probable duration of the country's lumber supply. Special studies of the manufacture of cooperage stock, of vehicles and implements, and of boxes, and of certain kiln-drying methods, gave results of decided value both to the

manufacturers and to timber-land owners. Wood as a paving material was also studied, and experiments were started to discover the best kinds of wood to use and how they should be treated and laid.

BUREAU OF CHEMISTRY.

The activities of the Bureau of Chemistry during the year included a great variety of investigations.

EXAMINATION OF BUTTER, MILK, AND CREAM.

More than 800 samples of butter were investigated, to see if they complied with the requirements of the law relating to renovated butter. A study of the effects of cold storage upon the chemical composition of milk and cream was inaugurated, to determine the length of time during which such products can be safely kept in cold storage.

CEREAL INVESTIGATIONS.

The effect of environment upon the content of sugar in Indian sweet corn was studied. The almost universal use of sweet corn for food throughout the country renders such an investigation of peculiar interest to consumers as well as to producers. A single variety of seed was planted in different localities from South Carolina to Maine, and the quantity of sugar in the product was carefully determined. At the same time meteorological data were secured which are utilized in determining the effect of environment in all of its factors upon the composition of the product. It was found that within twenty-four hours after harvest, if exposed to ordinary temperatures, a very considerable percentage of the sugar has disappeared from the grains of the corn. This fact has led to the observation that it is necessary to market the product as soon as possible after harvest, and meanwhile to keep it at as low a temperature as can be secured.

Studies looking to the improvement of the different varieties of Indian corn, by selection based upon analytical data, were undertaken. These studies are a continuation of those conducted the preceding year upon the effect of environment on the chemical composition of the sugar beet. In all, over 3,000 analyses were made of cereals in the prosecution of the above investigations. These investigations also include the effect of environment upon the chemical composition of barley as related to the brewing industries.

STUDY OF DENATURED ALCOHOL.

An important investigation was also begun upon the economic production of alcohol from various raw materials in relation to the production of denatured alcohol for industrial purposes. The object of this investigation was to discover the value of various waste materials

of factories—wood, molasses, sweet potatoes, cornstalks, etc.—in the production of alcohol for denaturing. This work is likely to prove of great value to our farmers in developing new sources of income from the production of denatured alcohol for industrial purposes.

TESTING OF SUPPLIES FURNISHED UNDER CONTRACT.

In the Contracts Laboratory, the object of which is the examination of materials furnished to the different Departments of the Government under contract, 69 samples were examined for the War Department, 19 for the Navy Department, 65 for the Department of the Interior, 36 for the Treasury, 73 for the Post-Office, 1 for the Department of Commerce and Labor, 73 for the Government Printing Office, and 59 for the Department of Agriculture. These examinations were of the most rigid character, and the result of the work has been to secure a much higher quality of material than was formerly supplied under the contract system.

EXAMINATION OF DRUGS.

The examination of drugs has been particularly fruitful during the year. Five hundred and fifty-three samples were examined for purity and quality. A large part of the work of the Drug Laboratory has been in connection with the Post-Office Department for the purpose of suppressing traffic in fraudulent preparations transmitted through the mails. As the result of these investigations a large number of fraud orders have been issued forbidding the use of the mails for such purposes. Other important investigations were undertaken in the testing of chemical reagents, of oils and essences, and of plant drugs.

ANALYSIS OF WATERS, INSECTICIDES, AND CATTLE FOODS.

The examination of waters used as beverages has been continued, and also the analysis of waters used for irrigation. Thirty-nine samples of insecticides were investigated during the year. Studies were made also of the lime-sulphur-salt wash and allied mixtures. One hundred and fifty-four samples of cattle food were analyzed to determine the quality of the cattle foods sold upon the markets. Studies were also made of the injurious effects of fumes from smelters upon vegetation, and testimony was given in the courts relating thereto. It is evident that the sulphurous acid fumes produced in most smelters are of a character to injure vegetation and also animal health in a region very widely extended about the factory. It appears probable that in the near future smelters will be required to convert the sulphurous acid into sulphuric acid or some other substance which will not cause the injuries above mentioned.

STUDY OF TANNING MATERIALS, PAPER, AND TURPENTINE.

The study of tanning materials was continued, especially of the Sicilian sumacs. The effects of different tanning materials upon the character, quality, and durability of leather were investigated. Investigations of great importance, not only to the various Departments of the Government but to the people in general, are those relating to the character of paper used for public records. Investigations have been continued respecting the composition of turpentine distilled from wood and its relations to the ordinary turpentine.

FOOD INSPECTION.

The food and drugs act, June 30, 1906, imposes upon the Department additional duties of a most important character. The two chief purposes kept in view by this act throughout all its sections are, first, to prevent the introduction of any injurious or debasing substance into foods or drugs, and, second, to secure the correct labeling of all food and drug products. This act applies to all interstate and foreign commerce in all foods and drugs, and also to all imported meat food products. The proper enforcement of this act must prove of immense benefit to all the people of this country in securing freedom from adulteration and fraud. Regulations providing for the administration of the law have been carefully prepared, and 30,000 copies have been distributed throughout the country.

The inspection of imported foods at the ports of entry has been extended, especially at New York, Boston, and Philadelphia. The earthquake and fire at San Francisco in April unfortunately destroyed our laboratory at that port. It is hoped that this enforced suspension, however, will not be of long duration.

Five thousand seven hundred and forty-nine samples of imported food products were examined during the fiscal year. Of the 1,246 samples which were found not to comply with the law, 531 were released without prejudice because it was evident that no intent to defraud or deceive the people of the country existed; 577 were admitted after being relabeled so as to comply with the provisions of the law; 138 invoices were required to be reshipped beyond the jurisdiction of the United States. In addition to the above number of samples, 8,735 inspections were made upon the floors of the appraisers' stores.

The effect of the food-inspection law on foreign commerce has been most salutary. In many cases kinds of food products which were formerly very generally misbranded are now found to be almost universally free of suspicion. There has been a very decided improvement in the quality of imported food products, due to inspection.

FOOD STUDIES.

The Division of Foods has also conducted special investigations into the extent of domestic adulteration of food products and an investigation of tropical and subtropical fruits, as well as of fruits of domestic production.

A very extensive investigation made to determine the character of distilled liquors, both those imported into the United States and those of domestic manufacture, has been practically completed.

The study of the effects of colors, preservatives, and other substances added to foods has been continued during the year, and most valuable data relating thereto are now being prepared for publication. This investigation is particularly valuable because the experiments are made upon human beings.

MICROSCOPIC WORK.

The microscope has become one of the most valuable adjuncts in the examination of food products and materials used for technical purposes. Micro-chemical investigations have been largely made in the work of the Bureau of Chemistry and have extended not only to foods but also to leathers, papers, tanning materials, and bacteriological examinations. The total number of samples examined during the year was 1,067. The bacterio-chemical work has been of extreme importance. This is especially true in connection with the work authorized by Congress on the effects of cold storage upon wholesomeness of food products. Particularly in investigating the relative merits of drawn and undrawn fowls when placed in cold storage, the bacterio-chemical examination is of vital importance. Studies have therefore been made to determine whether the bacteria of the intestinal tract migrate to the flesh of the fowl during the period of cold storage, and, if so, what chemical changes are produced thereby. The bacterio-chemical investigations have extended to a large number of other subjects, particularly to the chemical changes which take place in milk, cream, and evaporated and condensed milks, and to the general changes of a bacterial character which foods undergo on keeping.

BUREAU OF SOILS.

Underlying all attempts to improve the general agricultural welfare of the country lies the necessity for a correct knowledge of the character and variety of its soils. Such knowledge is fundamental, and without it no great progress can be made in securing further diversification of crops, the introduction of new crops, or the more economical production of the great staples now known.

THE SOIL SURVEY.

Since 1899 the Bureau of Soils has been conducting an investigation of the soils of the United States which will ultimately result in a thorough familiarity with the vast, varied, and but partially appreciated soil resources of the country. The purpose of this work is to ascertain the variety and extent of the chief characteristic soils of the country, to determine the crop or crops which can be raised to the best advantage upon each of these soils, and to discover what peculiarities of soil management are best suited to secure the maximum results on each soil in different and widely separated localities.

EXTENT OF THE SURVEYS.

During the fiscal year 1906 soil surveys covering 19,341 square miles, or 12,370,240 acres, were made in 29 States and 2 Territories. In all, to June 30, 1906, 251 different surveys have been made in 43 States and 4 Territories, covering a total area of 118,687 square miles, or 75,959,680 acres. These surveys have covered not only a wide range of soil and climatic conditions, but also the typical soils upon which the chief staple crops as well as many new and special crops are being produced.

THE PROBLEMS ENCOUNTERED.

The work of the soil survey in 1906 and in preceding years, while dealing chiefly with the characteristic soils upon which the staple crops—corn, wheat, cotton, grass, etc.—are produced in different sections and under different conditions of soil and climate, has also encountered many specific problems of wide interest and application. The opening of large areas for agricultural occupation has necessitated in several States a study of the existing soil types in order that the appropriate crops for production upon each might be determined. The widespread interest in the agricultural capabilities of undrained lands in many sections has led to demands for surveys which shall determine the character of crops to which such soils may be farmed after reclamation. The breaking up of large dry-farmed ranches for more intensive forms of agriculture under irrigation has also necessitated surveys which could be used as a basal guide in crop selection. The extension of crops like tobacco and alfalfa into entirely new areas whose soil adaptations were formerly unknown has been made possible by the soil surveys. The introduction of new crops has been accomplished along the lines suggested by the surveys. One of the chief purposes and uses of the surveys has been to aid individual farmers in the selection of land suited to general or special crops in regions unknown or but partly known.

THE SOIL RESOURCES OF THE COUNTRY.

In the work of the soil survey, since its inception in 1899, 461 distinct types of soils have been encountered. Some of these types are of great extent, covering areas measured by thousands of square miles. Still others are of local extent and distribution. Some are distributed over a considerable range of climatic environment. Others are so restricted that they may be said to lie in a single climatic belt. The great striking fact, however, is that with such a great variety of individual soils only about a dozen important crops are now produced in the entire country. Again, the same crop is produced with the greatest diversity of success or failure upon a great variety of soils, to some of which the crop is well suited while upon others it is annually produced at a loss. Before the farmers of all sections of the United States can reduce agriculture to a basis of permanent business success the knowledge of these facts must be thoroughly disseminated and fully understood.

It has been found that in addition to the broad subdivision of the country into a humid region, an arid region, and a rather indefinite semiarid region, there are at least thirteen grand divisions among the soils which may be termed soil provinces. The soils of the Atlantic and Gulf Coastal Plains differ materially from those of the Piedmont Plateau. The soils of the glaciated region of the Northern States are materially different from those of the limestone valleys, and from the alluvial bottom lands or the residual prairies of the Western States. Still greater differences exist between the soils of the Pacific coast valleys or the Great Interior Basin and those of the Eastern State provinces. All of these differences have their deep significance in the selection of crops and in the management of the soils. Even within single provinces there are groups of soils which differ profoundly from all others, and these differences must be recognized and their crop signification understood. Each series also ranges from the coarsest sandy and gravelly types or individuals to the finest-grained clays. No two of the numerous individual soils possess exactly the same characteristics, and no two are, therefore, adapted in the same degree to exactly the same crops nor to the same treatment and handling.

When all of these differences have been ascertained, and when the significance of these differences comes to be understood, the country will be able by the introduction of new crops and by greater specialization in crop production to increase greatly the agricultural efficiency of every tilled acre.

DEMANDS FOR THE WORK.

Each year brings an increasing number of requests for survey work in particular localities to serve a great diversity of interests. The development of new lands in the United States has not ceased and the

need for specific and unprejudiced information concerning soils in newly developed regions has become widely recognized. The extension of tobacco culture through certain portions of the Gulf States has led to numerous requests for surveys to locate areas of soil where the Cuban type of filler tobacco may be grown successfully. Only a few soils are suited to the production of this leaf, and unless such soils are found in an area the attempt to introduce the crop must result in failure. The growth of the fruit interests in all sections of the country has led to widespread demands for surveys to determine what soils are peculiarly adapted to the growing of apples, pears, peaches, grapes, or citrus fruits, the location of these soils, and their extent. The depression of farm values in some sections has called attention to the possibility of rehabilitating these farms and soils through the introduction of new crops and of new methods, and surveys are requested to furnish guidance along these lines. New areas for the production of market-garden and truck crops are being developed along the Atlantic and Gulf coast lines, and surveys have been requested for many of these areas. The northward spread of the culture of rice upon prairie lands has given rise to requests for surveys to indicate soils and regions where this crop might be introduced.

As a result the Bureau of Soils has always on file requests for several times as many surveys as can be made during any one year, and the completion of each year's work is accompanied by an increased rather than a diminished volume of requests. While such a condition is gratifying from the standpoint of public appreciation of the value of the work, it is embarrassing and unsatisfactory because of the necessity for selecting among so many requests of almost equal urgency those areas which may be undertaken each year. The public demand for the making of these surveys and the constant application for survey reports, not only for areas which have been surveyed, but also for those which have not yet been undertaken, both evince the necessity for a considerable increase in the volume of soil-survey work in the immediate future.

RECLAMATION OF ALKALI LANDS.

The progress of the work on the several alkali reclamation tracts during the fiscal year just closed has been gratifying, both as regards the immediate success of the experiments and as regards the stimulating effect that these results have had upon private initiative in the work of reclaiming similarly affected neighboring lands.

PROGRESS ON THE UTAH TRACT.

On the Swan tract, near Salt Lake City, Utah, the work consisted largely of experiments with various crops, as the removal of alkali had practically been accomplished by repeated flooding in 1903 and

1904. The thrifty growth of alfalfa and of other crops, not perhaps as sensitive to alkali, clearly demonstrates the great changes that have taken place in the soil since it has been treated. Formerly this field presented a desolate appearance, with large areas heavily incrusted with alkali. The success of this experiment can not but be far-reaching in its influence upon the alkali question in the Salt Lake Valley.

COMPLETION OF WORK AT FRESNO.

Our earlier work on the Toft-Hansen tract, near Fresno, Cal., had freed the upper layers of soil from alkali, and very satisfactory crops had been grown; however, while the alkali question had been solved, a constant source of danger was the high ground water, which rises very rapidly in this district after water is turned into the canals each spring. The original drainage system was not very deep, and the question of keeping the drains free from sand and silt proved serious. In order further to experiment with the lowering of the ground water, it was thought advisable to install a new drainage system. This was completed in November, 1905. The entire drainage system was lowered from 1½ to 2½ feet, and the ground water is now kept at a safe depth, not only under the land drained, but under adjoining farms to the extent of 200 acres.

The success of this work has proved of great value to the farmers of the alkali and seepage-infested district about Fresno, and many have signified their intention of undertaking work similar to that carried on by the Bureau of Soils. At the close of the irrigation season of 1906, the Bureau's work in the Fresno district will close, as the owners of the land are well pleased with the reclaimed condition of the soil and the success of the newly installed drainage system.

CONTINUATION OF THE WORK AT YAKIMA, WASH.

In Washington, in the Yakima Valley, the results have not been quite as satisfactory as was hoped when the work was commenced. While parts of the Gervais tract, near North Yakima, have been thoroughly reclaimed and produced in 1905 a heavy crop of hay, valued at $160, other parts of the tract have not yielded to treatment so readily. That some parts of the tract still contain appreciable quantities of black alkali is evident from the crop returns, from repeated chemical tests, and from the characteristic dark stains in the soil. It is somewhat difficult to explain the retention of alkali by the soils of the Yakima Valley. It is well known that hardpan retards the movement of alkali, and it seems probable also that the volcanic ash soils of this valley may have a high absorptive capacity, enabling them still to retain injurious quantities of black alkali in spite of repeated flooding. Good lands in this region produce such profitable crops that the exact

treatment for the alkali lands should be ascertained if possible, even though the total cost of reclamation be great as compared with other districts.

RAPID COMPLETION OF THE RECLAMATION WORK IN ARIZONA.

The record of the Cummings tract, near Tempe, in the Salt River Valley, Arizona, is excellent. The drainage system was installed early in 1904, but no water was available for leaching out the alkali until many months later. When the water supply became more abundant the removal of the alkali was comparatively simple. At the present time 14½ acres support a fine stand of alfalfa, planted in November, 1905, while the remainder has produced a heavy crop of barley. The owner of the land is fully satisfied with the showing of the crops and only awaits the seeding of the small tract to alfalfa before accepting the land according to the contract originally agreed upon. As the water supply of the valley is still further increased by the extensive operations of the United States Reclamation Service in constructing storage reservoirs, the subject of eliminating alkali and controlling the ground water will become more important, and the Bureau is very fortunate in having undertaken and completed this work at such an opportune time.

RESULTS IN MONTANA.

The showing of the O'Donnell tract in the Yellowstone Valley, Montana, is fully as good, if not better, than the one just mentioned. The drainage system was installed during 1904, but too late to allow any flooding. During 1905 the land was continuously flooded for several months. From the outset the drainage system worked perfectly and large quantities of alkali were removed by the drainage water. Tests made in June, 1906, showed that the alkali content to a depth of 4 feet had decreased to approximately 0.2 per cent over the entire tract. In 1904 the soil contained more than 1 per cent to a depth of 4 feet, largely concentrated in the first and second feet. The comparison shows the extent to which the alkali had been removed by a single year's flooding. Early this year the soil was put in order and seeded to oats. This crop produced a yield that compared favorably with the most productive lands in the valley.

Since it has been shown that alkali can be removed from the soils in the Billings district the outlook is most promising. One of the worst alkali and seepage areas has been included in a drainage district, and a deep outlet ditch now constructed will serve to carry the surplus water from smaller, more detailed drainage systems in individual fields. Smaller local drainage systems are also being formed by private enterprise.

NEED FOR CONTINUING THE DEMONSTRATIONS.

In carrying on the work in reclaiming alkali soils we have had many different conditions to meet and local difficulties to overcome. At each tract the character of the soil differed from that of the other tracts, and at no two places are the alkali conditions nor the details of attacking the problem the same. This makes plain the wisdom of extending the work to other affected districts in order that full and exact plans may be placed in the hands of the farmers suffering this common evil of the arid West.

Already urgent requests for the extension of this work are on file in the Department, and in view of its great economic importance it is the intention to follow the completion of the present demonstrations with the reclamation of small tracts in some other of the worst affected sections. There is no one soil problem more important to a large number of our western farmers than this, and none, happily, that is capable of such quick solution or that involves so great and so certain immediate increase in their wealth.

TOBACCO INVESTIGATIONS.

During the fiscal year just closed the Bureau of Soils has continued its investigations for the improvement of tobacco in Texas, Alabama, Ohio, Virginia, and Connecticut.

EXPERIMENTS IN TEXAS.

The tobacco grown in Texas during the preceding year was distributed to the trade for the purpose of ascertaining its commercial value. In all 300 samples were sent out, and from the numerous replies received it can be positively stated that the tobacco produced in Texas meets the requirements of the trade as a high-class domestic filler. About 200 acres are now being grown on the Orangeburg soils in Nacogdoches, Anderson, Houston, and Montgomery counties in east Texas, while in central Texas, in Lavaca and Lee counties, experiments were conducted on similar soils. The industry is now assuming a commercial status, as a ready market has been created for the leaf. Great interest has been shown by the trade, by railroads, and by local interests in east Texas as a tobacco-producing region, and, with the promising beginning made in the counties mentioned, there is every reason to believe that this section of the State will soon be recognized as an important factor in our tobacco industry.

PROSPECTS IN ALABAMA.

The investigations for the production of filler leaf in Alabama have this past year been extended into Dallas County, in the southern part of which the Orangeburg soils appear. In Perry County the acreage

increased over 100 per cent. A ready market has been found for the product, and this has proved a stimulus to the growers. The tobacco produced is similar in quality to the Texas and Florida leaf, and the cost of production is a little less.

FERMENTATION AND SELECTION IN OHIO.

In Ohio the work of introducing the bulk method of fermentation has been continued, and over 25,000,000 pounds of tobacco have been fermented according to the method prescribed by the Bureau of Soils. It has taken a period of five years to accomplish these results, and the system is now so well established in Ohio that the packers should be able to proceed without further supervision by our experts. Besides the fermentation work, the work of introducing Cuban seed filler in Ohio has been continued, 25 acres having been planted by the farmers under the direction of the Bureau. This was contracted for with local packers at prices ranging from 18 to 20 cents a pound.

In Ohio, also, cooperative experiments have been conducted with the Bureau of Plant Industry in the selecting and breeding of improved types of tobacco, with a view to securing types of leaf giving a larger yield and having a uniform quality. Selections were made of Zimmer Spanish, Little Dutch, Ohio Seedleaf, and Ohio Cuban. It is believed that by this method of selection of seed native varieties of Ohio tobacco may be greatly improved, since where so many varieties are grown, as in the Miami Valley of Ohio, there is great danger of their becoming mixed.

EXPORT TOBACCO IN VIRGINIA.

The experiments begun in Virginia in 1904 with heavy fire-cured tobacco have been continued during the past fiscal year. In the first year of this work it was demonstrated that by the use of carefully selected fertilizers the profits in growing this type of leaf could be increased considerably as compared with those obtained by the Virginia farmer. During the past year the same treatment of the same land was followed, and, between the two crops of tobacco, rye was sown as a cover crop and plowed under in the spring of the year. The results obtained show the accumulative effects of the fertilizer and cultural methods used. The land was divided into 3-acre plats. On one the fertilizer practice common to the locality was followed, on the second a slightly better brand was applied, and on the third a still more expensive application was made.

The cost of production of the three plats was respectively $44.50, $63.60, and $85.49, which shows a net profit of $15.63 on plat 1, $37.01 on plat 2, and $40.10 on plat 3. It is interesting to note that the same plats of ground receiving the same treatment in 1904 netted profits of $5, $21, and $24, respectively, showing gains in 1905 over

1904 of $10.63, $16.01, and $16.10, respectively. These results are highly significant as indicating what may be done in this important tobacco district by the use of such methods as are practiced, for instance, by the Connecticut Broadleaf growers.

BEGINNING OF EXPERIMENTS WITH VIRGINIA BRIGHT TOBACCO.

Investigations for the improvement of the Bright tobacco of Virginia were also begun during the past fiscal year (ended June 30, 1906), in cooperation with the Virginia Experiment Station, the experimental field being situated near Chatham, in Pittsylvania County, the center of the Bright tobacco belt of Virginia, and within 20 miles of Danville, the largest market for this class of tobacco. The experiment is still in progress, and it will be impossible to report definite results until next year.

CONNECTICUT SHADE-GROWN TOBACCO.

In the Connecticut Valley the work of producing, under shade, a wrapper leaf having all the qualities demanded by the trade has been continued in connection with the breeding experiments of the Bureau of Plant Industry. Eleven selections were taken in a 4-acre tent, seven from Sumatra seed and four from Cuban seed of the third generation in Connecticut. The yield of Sumatra ranged from 1,445 to 1,612 pounds per acre, and of Cuban from 1,134 to 1,384 pounds per acre. Out of these eleven types there have been selected two types of Sumatra and one of Cuban seed that appear to meet the demands of the trade.

Besides the area in the experimental tent of the Department, there were grown by private planters during the year about 120 acres under cloth shade, both Cuban seed and Connecticut Broadleaf being planted. This is a slight increase over the acreage planted the preceding year and indicates that the trade is becoming interested in the shade product. One firm growing Broadleaf sold the tobacco for $1,061 an acre, giving a profit of about $300 an acre. The Cuban tobacco was sold for $1,200 an acre. During the summer of 1906 the crop grown by the Department from selected seed of both the Cuban and Sumatra varieties was distributed to thirty-three of the largest leaf dealers and cigar manufacturers in the principal cities of the East. These were sent out with a request that they test the leaf and report to the Department their opinion of its quality and its adaptability for manufacturing purposes. Up to the time of closing this report answers have been received from twenty-five of those to whom samples were sent, and with one exception they report that the tobacco has all the qualities demanded by the trade in a domestic cigar wrapper, and if tobacco similar to the samples sent can be grown on a commercial scale they do not hesitate to say that a ready market can be found for it.

There can be no question that tobacco of this quality can be produced

on a commercial scale by careful growers if the methods used and recommended by the Bureau of Soils are followed. Notwithstanding the uniformly favorable reports received from the trade on the merits of this tobacco, the Bureau, however, would caution the prospective grower against embarking in the industry on too large a scale at the outset.

PREVENTION OF POLE SWEAT.

Owing to the serious damage caused annually in Connecticut by pole sweat or house burn, the Bureau of Soils conducted some preliminary investigations in curing sheds containing both the cut and primed tobacco. A detailed record of the moisture and temperature conditions in each shed was kept, as also of the condition of the tobacco, with a view to determining the point of relative humidity and temperature of atmosphere at which tobacco would begin to pole sweat and the means to prevent the atmosphere of the shed becoming such as to favor its spread. This study will be closely followed, as it is believed that results can be obtained which will be of great value to the Connecticut growers.

Urgent demands have been made upon the Department to extend its operations into Florida, Maryland, Wisconsin, and Tennessee, but owing to the limited appropriation for this work it has so far been impossible to comply with these requests.

BUREAU OF ENTOMOLOGY.

Practically all of the investigations under way in the Bureau of Entomology at the time of my last report have been continued with excellent results, and several new and important lines of work have been begun.

THE MEXICAN COTTON BOLL WEEVIL.

Encouraging progress has been made in the work against the Mexican cotton boll weevil, as shown by an extensive canvass of the cotton planters who have followed the recommendations of the Bureau.

Owing to climatic conditions in the summer and fall of 1904 and in the winter of 1904–5, some of the area that became infested late in the summer of 1904 was entirely devoid of weevils in the early part of 1905, but the fall movements of the weevil in 1905 more than covered this area. This permitted studies for which there had been previously little opportunity, and many points which had a bearing upon the possibility of the continued advance of the pest were investigated.

EXPERIMENTAL FARMS.

The continuation of the experimental farms at fourteen places in Texas has been deemed desirable, as the value of experimental field work depends largely upon the number of seasons through which it has

been carried. Two additional experimental farms have been carried on in Louisiana. The whole acreage placed under contract in these experiments is 877.

The modifications in the cultural system of lessening damage, made necessary by the change in habits of the insect, were carefully studied in connection with the work carried on in the laboratory.

OTHER FIELD WORK.

In addition to experimental plats on a large scale numerous field experiments were conducted, including an extensive experiment in the hand picking of infested bolls and considerable other work directed to the solution of questions which can not be tested with the fullest practical effect in the laboratory.

The continued spread of the weevil has been carefully watched, and publications regarding the new territory infested have been issued in cooperation with the Weather Bureau. Careful study has been made of the conditions in western Texas in order to determine whether the weevil is likely to spread to that part of the State in spite of the general idea that such spread will not take place.

LABORATORY WORK.

In the well-fitted laboratory now located at Dallas, Tex., the effects of different temperatures and the condition of food supply upon the development of the weevil were tested, the breeding of parasites was continued, and a special study was made of a native ant which seems to be becoming more and more an important factor in the natural control of the weevil. Investigations of the distribution of this ant, its adaptability to different soil conditions, and the possibility of its artificial propagation have also been made.

TRUE PARASITES OF THE BOLL WEEVIL.

Since the weevil entered Texas native parasites have had little effect upon it until recently. During the year, however, it was found that in the Brownsville region—first entered by the weevil about 1893—native parasites have accommodated themselves to its habits, and now at least 50 per cent of the early stages are sometimes destroyed by these parasites. Consequently much attention is being paid to the parasite question, in order to determine whether it will be possible to assist the work of these beneficial insects. It seems probable that the small results gained from the work of parasites down to the present time are largely due to the recent invasion of the cotton fields of the South by the injurious insect.

COOPERATION WITH THE LOUISIANA CROP PEST COMMISSION.

Cooperation with the Louisiana Crop Pest Commission, begun in 1904, was continued during the year, three assistants being employed by the Bureau for work in Louisiana. During the season of 1905 it

was planned to enter upon an extensive study of the so-called migratory movement of the boll weevil in order to learn, if possible, some method of checking its further advances, or at least to learn more definitely the approximate time when other regions may become infested. On account, however, of the occurrence of yellow fever and the consequent rigid quarantine, it was impossible to carry on this work in full, but a number of important observations were made. In cooperation with the commission more than 25,000 weevils were carefully studied under natural conditions during the winter.

THE COTTON BOLLWORM.

The work on the cotton bollworm during the fiscal year was largely in the character of demonstrations, indicating the value of conclusions already reached and detailed in the last annual report of the Entomologist, and successful efforts were made locally in the extermination of the bollworm by means of poisons.

OTHER COTTON INSECTS.

The work on other cotton insects has been done largely in cooperation with the Texas Agricultural Experiment Station. A field agent of the Bureau was stationed at the Texas Agricultural College, devoting his attention to the other insects affecting the cotton plant. The important discovery has been made that it is possible to propagate the predaceous enemies of the cotton plant-louse, an insect which sometimes causes great damage to young cotton. It is believed that this work will lead to a practical method of controlling the pest.

INTRODUCTION OF BENEFICIAL INSECTS.

The most important work in connection with the introduction of beneficial insects has been the importing from Europe of the parasites and predaceous enemies of the gipsy and brown-tail moths, in cooperation with the officials of the State of Massachusetts.

PARASITES OF THE GIPSY MOTH AND BROWN-TAIL MOTH.

It has been shown that it is an easy matter to bring the European parasites of these injurious insects to this country, simply by collecting numbers of the larvæ and chrysalides in different parts of Europe and sending them direct to Boston. A certain percentage of these insects on arrival in New England have given out the European parasites, which have either been cultivated in wire-gauze inclosures, with plenty of food, or have been liberated in the open, there being chosen for this purpose patches of woods not subject to forest fires or to remedial work against the insects. It has been ascertained further—and this is a fact hitherto unknown even to European entomologists—that the young larvæ of the brown-tail moth in their overwintering

nests in Europe are extensively parasitized. Therefore, during the winter of 1905–6 over 117,000 nests of the brown-tail moth were collected in 33 different localities in Europe, ranging between North Germany, South Hungary, and West Brittany, and comprising a large range of varying elevations and climatic conditions. More than 70,000 parasites were reared from these nests on American soil. About 8 per cent of these were hyperparasites; that is, parasites upon parasites.

By means of specially constructed cages the hyperparasites were separated and destroyed. The primary parasites were placed in out-of-door cages or liberated in the open. The largest colonies included 10,000, 15,000, and 25,000 parasites, respectively. Owing to the very wet season a fungous disease prevailed among the caterpillars, vitiating to some extent the results of the experiments, but nevertheless three species of parasites were seen to lay their eggs in American-born caterpillars, and there is positive proof of the development on American soil of at least one complete generation of two of the European species. It has been shown that they may breed successfully through the season.

Egg parasites of the brown-tail moth have also been imported during the summer, and have been seen to lay their eggs in the eggs of North American injurious insects. Two important European predatory ground beetles have been successfully imported, and have bred through an entire generation upon American soil. Large numbers of Tachina flies have been reared from European specimens of the larvæ of both the gipsy moth and the brown-tail moth, and are breeding in the vicinity of Boston.

The greatest care has been taken to prevent the introduction of hyperparasites and other injurious insects, and there seems every reason to suppose that sooner or later the complete natural environment of both the gipsy moth and the brown-tail moth will be established in New England, placing them on a par with European conditions, thus greatly reducing their present importance.

NEW LADYBIRDS FROM EUROPE.

During the late winter months and spring of 1906 several species of European ladybirds, well known as destroyers of plant lice, scale insects, and soft-bodied insects of other groups, have been imported from Germany, France, and Austria. All of these have been liberated in the vicinity of the parasite laboratory at North Saugus, Mass., the country about being orchards and forests, with an occasional vegetable garden, promising plenty of food for the beneficial species.

THE KELEP OR GUATEMALAN ANT.

Efforts to successfully overwinter in Texas the kelep or Guatemalan ant enemy of the cotton boll weevil have failed and a possible useful rôle for this insect in Texas is seemingly very slight. It is possible

that this species may have some economic value in some of our tropical or subtropical possessions, where the climate will be more suitable than in Texas.

THE SENDING OF USEFUL INSECTS ABROAD.

It is possible, in many instances, to secure the sending of beneficial insects by the official entomologists of other countries without expense to the Department, as was done notably in the case of the introduction of an important enemy of the black scale from the government of Cape Colony, South Africa. In return for such services and as an earnest for possible future courtesy of the same sort exportations of parasitic and predatory insects have been made, under the auspices of the Bureau of Entomology, to foreign countries. A notable instance has taken place during the fiscal year. A scale insect which occurs abundantly upon various fruit trees in portions of the United States is a serious enemy to the mulberry tree in Italy, and therefore large sendings of parasitized scales of this species have been shipped to Professor Berlese, Director of the Royal Station for Agriculture and Entomology, at Florence. After arrival two species of parasites were bred in some numbers, and efforts are now being made to colonize them in Lombardy. It is hoped that they will prove effective aids in the eradication of the mulberry scale.

INSECTS DAMAGING FORESTS.

Investigations of insects damaging forests have progressed in a satisfactory manner in cooperation with the Forest Service of the Department. Numerous problems have been studied and a large store of general information upon forest insects has been accumulated.

Field work has been conducted from stations in West Virginia, North Carolina, South Dakota, Idaho, Washington, and California, the locations of the stations being determined by the advantages offered at the points selected for the study of some special problem or problems.

A special investigation was carried on in regard to the Black Hills beetle, which has extensively ravaged the forests in Colorado, and the results prove to be in the highest degree satisfactory and have been published in Bulletin 56 of the Bureau. The recommendations are now being actively followed by private persons with excellent chances of checking what might otherwise prove a most serious invasion.

The conditions in the Black Hills are not so encouraging, owing, doubtless, to the failure of the parties interested to realize the importance of the recommendations of the Bureau. These difficulties, however, have now been partially overcome, and all concerned seem alive to the seriousness of the situation.

Investigations in the South of the destructive pine-bark beetle and of a number of important insects injurious to forest products have been carried on, and studies have been made in regard to the insect enemies of forest reproduction. Special studies and recommendations have been made concerning the western pine-bark beetle in the region north of Boise, Idaho, and a study of the forest insects of the Pacific slope has been carried on.

INSECTS DAMAGING DECIDUOUS FRUIT TREES.

For the investigation of insect enemies of deciduous fruit trees field stations at Youngstown, N. Y., and Fort Valley, Ga., were carried on to the close of the growing season of 1905, and in the spring of 1906 others were started at Myrtle, Ga., and North East, Pa. Later another one was established at Nebraska City, Nebr. In the course of this work some studies have been made of the parasites of the San Jose scale, and experiments have been made with a number of insecticide mixtures. The chemical study of the lime-sulphur and other washes has been undertaken in cooperation with the Bureau of Chemistry. New studies have been made of the plum curculio. The peach borer has also been studied throughout its geographic range, and extensive demonstration work has been done in Nebraska on remedies for the codling moth, in cooperation with the Bureau of Plant Industry, which at the same time was dealing with the apple scab, combination treatments for both being carried on cooperatively. Cooperation in this work is also under way with the several other experiment stations and the Georgia State entomologist.

FIELD-CROP INSECTS.

The most important work in connection with field-crop insects has been upon the Hessian fly and jointworms, especial investigations having been made of the Hessian fly in the spring-wheat regions. It was predicted that this insect would not damage wheat in regions where the spring crop is exclusively grown. This has proved to be a fallacy, and by reason of remarkable changes in the life history of the insect it has adapted itself to the conditions existing in the far northwestern country. This means a radical modification in remedial work, and the studies have indicated that it will not be difficult to bring about conditions of comparatively small insect damage. Important results have also been reached in the study of parasites of the Hessian fly, which will probably have a marked effect upon the multiplication of the fly. In the same way the jointworm investigations have resulted in the acquisition of important knowledge, both regarding possible remedial work and the handling of parasites. Studies have also been made of clover seed and clover insects, and also of other field-crop pests.

INSECTS AFFECTING VEGETABLE CROPS AND STORED PRODUCTS.

Work on insects affecting vegetable crops and stored products has been continued along the same lines as conducted in previous years. Insects affecting the sugar beet have been studied with care, and a special investigation has been made of a leaf hopper affecting this crop in Utah, Idaho, and Colorado. Many other insects of this group have been under careful observation, and results of value have been obtained.

INSECTS WHICH CARRY DISEASE TO MAN AND DOMESTIC ANIMALS.

The work of the Bureau on the subject of mosquitoes has been continued. A further study of the yellow-fever mosquito was made in the autumn of 1905, and experiments were made with remedies and methods of destruction against both larvæ and adults. Records have been brought together of the life histories and geographic distribution of the majority of the mosquitoes inhabiting North and Central America and the West Indies.

In the spring of 1906 a publication was issued upon the subject of the house fly, calling attention to its agency in the spread of typhoid fever, pointing out proper methods for its control, and urging the adoption of these methods by individuals and communities.

It was shown by observations made by the Bureau of Entomology upon a series of stables in two different sections of the city of Washington that it is a comparatively easy matter greatly to reduce the numbers of the house fly in any given community at a comparatively slight expenditure of funds and effort.

The investigation of the life history of the Texas cattle tick, mentioned in the last annual report, has been continued in cooperation with the entomologists of the States of Louisiana, Arkansas, Alabama, Tennessee, and South Carolina. This work has considerably increased our knowledge of the development of the tick, and in connection with this work the life history and habits of a number of other common ticks, frequently confused with the fever-transmitting species, have been investigated.

SCALE INSECTS AND EXPERIMENTAL WORK WITH INSECTICIDES.

This work, in special charge of the Assistant Chief of the Bureau of Entomology, has been continued. An immense amount of material in this group is sent in to the Bureau for identification and advice and the work grows in importance and value.

A thorough inspection was made of all new plants which the Department of Agriculture is importing from different parts of the world to detect and destroy any new insect enemies, principally scale insects, which might be brought in with them.

The work with insecticides has covered tests with standard insecticides, fumigation of mills, granaries, and dwellings against insect pests, and many new insecticide ideas or mixtures, which come to the Bureau for attention almost daily, have been examined and reported on.

Tests carried on upon a large scale and in a very thorough manner with sulphurous-acid gas have fully demonstrated its usefulness.

BEE CULTURE.

The work on bee culture has greatly increased. A large number of queen bees of different varieties were reared and distributed from the Department apiary, as well as from the substation at Chico, Cal. Investigations of the giant bees of India and the Philippines were continued through the year.

The various methods of queen rearing have been tested in rearing queens for distribution, and studies in bee diseases and in the important subject of honey-producing plants have been carried on.

SILK CULTURE.

There has been no change in the method and scope of the work on silk culture during the year. The correspondence was increased; a supply of eggs has been brought from Europe and distributed to correspondents in the United States; mulberry stock has been distributed, and cocoons have been purchased from correspondents and reeled.

OTHER INVESTIGATIONS.

Work on insects injurious to strawberry, raspberry, blackberry, and other bush fruits has been continued, and studies have been made of insects injurious to flower gardens and in greenhouses. An especial study of the insect enemies of roses is under way. The study of insects affecting shade and ornamental trees has also been continued, and an investigation has been made into the habits of the gad flies.

Routine work in the laboratory has greatly increased and biological studies have been made of nearly 500 species not hitherto studied. Increase has also been noted in the work of determining specimens for the entomologists of experiment stations and other workers. Many thousands of specimens have been received for this purpose.

BUREAU OF BIOLOGICAL SURVEY.

GEOGRAPHIC DISTRIBUTION.

LIFE AND CROP ZONES.

The Biological Survey deals with many of the problems of the farm, orchard, and stock range, and aims to answer in a practical way many of the questions that arise in their management. One of the most

important of these is the selection of crops and breeds of stock adapted to the local peculiarities of temperature, moisture, and other climatic factors that prevail, not only in different areas, but which in mountainous regions often characterize different parts of the same farm. A direct and reliable guide to such selection, apart from costly experimentation, is afforded by the distribution of the native plants and animals, for it has been learned that animals and plants are not scattered haphazard over the land, but in their distribution are governed by fixed laws. Thus the association, on a given area of certain birds, mammals, trees, and shrubs, presupposes the existence there of certain climatic and physical conditions.

It naturally follows that there is a direct relation between the plant and animal life of such an area and the nature of the crops that can be grown upon it. The purpose of a biological survey of the several States is to supply life-zone maps based upon a study of the natural animal and plant life, followed by crop-zone maps with lists of fruits and crops which will best thrive in such areas. A generalized report of this nature, covering the United States as a whole, has been already published (Bull. 10, Biological Survey). The work is now being carried on in more detail and on larger scale maps in several of the Western States.

DISTRIBUTION AND MIGRATION OF DUCKS AND SHORE BIRDS.

As the game birds of the country diminish in numbers, and as their importance in the eyes of sportsmen and for food increases, the necessity of legislative protection becomes more imperative.

In order to afford an accurate basis for such legislation, the routes of migration and the time of arrival and departure of ducks and geese and the shore birds have been carefully studied.

ECONOMIC INVESTIGATIONS.

ECONOMIC MAMMALOGY.

The field included in this branch of the work is wide and important, the losses inflicted upon the agricultural and stock-raising interests in the United States by noxious animals amounting annually to many millions of dollars. The most prominent offenders are the wolves and the gnawing animals known as rodents—especially the rats and mice, rabbits, ground squirrels, and gophers. Much time and ingenuity and vast sums of money have been expended in devising means to restrict the numbers and minimize the damage done by these animals. Traps, poisons, and gases have been carefully experimented with under varying circumstances, and have proved more or less effective, but the farmer does not always possess the requisite time and skill to employ them to best advantage, and even when they serve to accomplish the object intended the cost is considerable.

Meanwhile agriculture is assuming more and more importance in the United States, and with increasing crops comes a corresponding increase in the numbers of the pests that destroy them.

In the hope of finding a remedy, the Bureau of Biological Survey is now engaged in experiments with epidemic diseases—diseases which in the course of nature break out at intervals and serve to reduce the numbers of rabbits, squirrels, mice, and other noxious animals to below the danger point. As some, if not all these diseases, are of bacterial origin, it is thought possible to obtain and preserve cultures of them for employment when and where occasion arises. Prior to their use in the field, however, a series of careful experiments is necessary to determine the character of the diseases—whether limited, as some undoubtedly are, to particular animals—the degree of their virulence, the extent of their communicability from animal to animal of a colony, and above all to make sure that human beings and farm stock are immune from their influence.

In cooperation with the Bureau of Animal Industry, experiments have been already made with a virus for destroying rats and mice, and in cooperation with the State Agricultural Experiment Station at Pullman, Wash., experiments are being tried with a disease endemic to one of the ground squirrels of that region. The results of the latter experiments are awaited with peculiar interest, since the area infested by ground squirrels in Washington, Oregon, and Idaho is very large, and everywhere over it great damage is done to the wheat crop.

With a view to eliciting timely information as to the prevalence of epidemic disease among rabbits, ground squirrels, prairie dogs, rats, and mice, a circular of inquiry has been widely distributed. The subject is one of large possibilities, and time and money will be well spent if effective and economical methods are found to relieve the farmer of part of the burden and expense of protecting his crops from rodent pests, which are as numerous and destructive as they are ubiquitous and elusive.

DEPREDATIONS BY WOLVES.

In cooperation with the Forest Service investigations are being made with a view to the reduction of the numbers of wolves on the stock ranges and on the game and forest reserves of the West. Wolves are still numerous in certain sections, and by reason of their size and strength constitute a formidable enemy to stock and to wild game. It is thought that effective means for the abatement of the nuisance have been found and a report on the subject will soon be ready for publication.

THE RABBIT PEST.

The damage to nurseries, orchards, and crops of the United States by rabbits has always been great, though happily nowhere reaching the proportions reported in Australia. Many experiments have been

made by assistants of the Survey for the purpose of discovering cheap methods of protecting orchards by wire fencing and by other means, and of reducing the number of rabbits by traps and poisons. It is believed that young trees in orchards and in forest reserves, where they are particularly liable to destruction by rabbits, can be cheaply and efficiently protected by cylinders of woven wire, and experiments are being undertaken in cooperation with the Forest Service for testing the efficiency of such protectors. Rabbits in various parts of the country appear to be peculiarly susceptible to epidemic diseases, and as they are one of our most destructive rodents special efforts are being made to detect the presence of one of these epidemics for the purpose of securing cultures as a means of reducing their numbers.

THE BOLL WEEVIL.

During the year investigations were continued in the Texas cotton districts with reference to birds that feed upon the weevil. The results are encouraging. In all, 28 species of birds have been found to be more or less active enemies of the insect. Included in this number is the nighthawk, heretofore not known to eat the weevil. The nighthawk proves to be an active consumer of the insect. Its protection by law therefore is earnestly recommended. This is all the more necessary, since the bird is often shot for food.

Of all the birds that prey upon the weevil, orioles are the most active and persistent. For this reason the possible introduction into the Gulf States of one or more additional species of these birds is being considered. Only one of the three species that visit the cotton-producing belt breeds extensively within it; hence if one is introduced it should be a species likely to make its summer home within the area infested by the weevil, as all birds are particularly assiduous in their search for insects during the time they are feeding the young.

CALIFORNIA FRUIT ORCHARDS.

Work in the California fruit orchards is being continued and a study made of the food habits of birds destructive to orchard fruit, with a view to the suggestion of preventive measures.

Careful investigations are being conducted also into the food habits of all birds that live in and around orchards, so that the orchardist may be clearly informed as to the beneficial species, in order that he may be able to discriminate between friends and foes.

SCALE INSECTS.

Few kinds of insects are so inimical to the health and existence of fruit trees and other crop plants as the scales, and owing to their small size and peculiar habits few are so difficult to cope with. It has been generally supposed that birds lend no assistance in the destruction of scales. This proves to be an error, for the Biological Survey has

already found that more than 50 species of birds eat scale insects. Not only is this true, but in the case of certain species, as the grosbeaks, scales have been ascertained to form a large percentage of the food.

GAME PROTECTION AND INTRODUCTION.

The experience of many countries proves how widespread is the desire to introduce foreign mammals and birds. When these are merely for cage pets or for exhibition in zoological collections, little or no harm results. But when, as frequently happens, exotic species are liberated in the hope that they will become acclimated and form permanent additions to the fauna, there is always danger that, like the English sparrow, they will be only too successful in adapting themselves to the new environment and prove serious pests. The disastrous experiments of Jamaica, Porto Rico, Hawaii, New Zealand, Australia, and other regions abundantly illustrate this danger. Several countries take the precaution of regulating such importations, the United States among the number. Since 1900 the Department of Agriculture has supervised all importations of live birds and mammals into the United States. A few well-known species of birds and mammals are allowed to enter without special authorization, but all others are refused entry except under permit by the Department. The number thus entered during the year was 654 mammals, 274,914 canaries, and 47,256 miscellaneous birds.

The growth of the trade in imported birds is made manifest by the fact that the figures show an increase of 25 per cent over those for last year, and of 33, 27, and 37 per cent, respectively, over those for 1903–4, 1902–3, and 1901–2. Despite the large number of birds and mammals imported under permit, averaging more than 6,000 a week throughout the past year, it is believed that no prohibited species was brought into the country.

Increased interest is shown in the importation of foreign game birds for stocking covers. During the year 864 European partridges, 116 capercailzie, 73 black game, and 59 other game birds were imported for this purpose. Some of these experiments promise excellent results.

Stocking covers with birds hatched from imported eggs has heretofore been unsuccessful in most cases. Last spring, however, of 5,564 eggs imported under permit by the Department, 5,500 were English pheasant eggs secured by the game commissioner of Illinois, who reports that 3,000 live, healthy chicks were obtained—an unusually large percentage.

Large shipments of birds are examined by inspectors and the number and kinds are reported to the Department. The expense of fees has hitherto been borne by importers, since no appropriation for the purpose was made by Congress. This arrangement proved unsatisfactory

and protest was made by importers. Since February 1, 1906, the Department has undertaken to pay these fees, and an appropriation should be made to sustain the service, as in the case of inspection of meats. The lack of such appropriation permits inspection only of the most important shipments.

INTERSTATE COMMERCE IN GAME.

The close surveillance of interstate traffic in game established in the Middle West has driven illegal shippers to the use of freight instead of express, and has brought the situation in that region under partial control. Attention will therefore be centered during the coming year on the Southwest, where systematic violations of the law are frequent. An effort will be made also to check numerous illegal shipments that occur in the South, particularly in West Virginia, Virginia, and North Carolina.

The limited means available for this work make progress slow and difficult. A sufficient sum should be appropriated to permit the employment of three supervisors, at Chicago, St. Louis, and Baltimore, respectively, to study conditions, secure evidence of illegalities, assist prosecuting officers, and aid generally in a more effective enforcement of the law.

BIRD RESERVATIONS.

One of the most successful methods of preserving the birds of a country is by setting aside regions that contain important colonies of breeding birds as bird reservations or "refuges." England, Australia, Canada, New Zealand, and other countries have followed this plan with great success, and in 1903 the United States inaugurated it by making a bird reservation of Pelican Island, Florida, to preserve the only colony of brown pelicans on the east coast of Florida. Afterwards two more reservations were established—Breton Island, Louisiana, and Stump Lake, North Dakota—and in the year just ended four more were added to the list, two in Florida, consisting of Passage and Indian keys, at the mouth of Tampa Bay, and two in Michigan, comprising the Huron Islands and the Siskiwit Islands in Lake Huron.

These reservations contain large colonies of water birds—ducks, gulls, terns, pelicans, etc.—and their establishment will serve to preserve certain native species from possible extermination and provide favorable places for the study of bird life. It has been found essential to have Federal authority to punish trespassers instead of depending on varying State laws, and accordingly, at the suggestion of this Department, Congress passed an act (approved June 29, 1906) providing a penalty for trespass on bird and game reservations. This law will enable the wardens on bird reservations to protect them from marauders.

BIG GAME REFUGES.

It is gratifying to state that part of the herd of dwarf elk presented to the Government by Miller and Lux was successfully transferred to the Sequoia National Park in November, 1905, thus insuring the preservation of this rare species.

It is now possible, also, to transfer to an ideal buffalo range in the Wichita game preserve the herd of buffalo offered to the Department by the New York Zoological Society, as Congress at its recent session appropriated $15,000 for the construction of the fence necessary for a proper inclosure.

The plan of preserving big game from extermination by providing game refuges where shooting is either prohibited or carefully regulated is at present attracting attention all over the world. In order to profit by the experience of other countries in a matter that must soon be of pressing interest in the United States, investigation has been made of the systems employed in Canada, particularly Ontario and Quebec, the Transvaal, Natal, British East Africa, Sudan, and Cape Colony. This work has been carried on by correspondence and will be continued and extended during the coming year.

GAME PROTECTION IN ALASKA.

The preservation of the game of Alaska continues to present difficult problems. With the present unsatisfactory game law, and no appropriation available for enforcing its provisions, the efforts of the Department have been confined to preventing export of heads and skins by trophy hunters and dealers in hides, a fruitful source of destruction.

INFORMATION CONCERNING GAME.

In performance of the important duty of collecting and disseminating information relating to game, the annual summary of game laws, posters of close seasons, and directory of officers and organizations concerned in the protection of game have been published as usual, and also various pamphlets relating to special features of game protection. In the near future it is intended to secure and publish information concerning hunting-license statistics, game refuges and preserves, introduction and propagation of game birds, duties of the modern game warden, and the cage-bird traffic of the United States.

The constant demand for information on these and kindred matters shows how important is this phase of the work. It is impossible to meet this demand satisfactorily with the present limited force and available means, and an increase in both is much needed.

DIVISION OF PUBLICATIONS.

The work of the Division of Publications continues inevitably to increase with the growth of the Department. The number of publications issued in 1904 was 972; in 1905, 1,072; and in 1906, 1,171. The number of copies issued in 1906 aggregated 13,488,021. The larger proportion of these publications consisted of reprints, but the new publications in 1906, exclusive of those of the Weather Bureau, numbered 414.

FARMERS' BULLETINS.

The total number of issues of Farmers' Bulletins during the fiscal year was 437, of which 404 were reprints, and the total number of copies was 6,568,000.

The demand for Farmers' Bulletins by Senators and Representatives, who under the law are entitled to 80 per cent of the whole number printed, has been so much larger than usual that practically none were left to carry over to the present fiscal year. There being therefore no surplus available and the appropriation for the current fiscal year being no larger than formerly, the number available for each Congressman will this year be greatly reduced. I have therefore felt obliged to include provision for an increase in the number of these bulletins in my estimates for the ensuing year. The number of copies of Farmers' Bulletins distributed during the past year on Congressional orders aggregated 5,279,476.

ADVISORY COMMITTEE.

On January 23, 1906, in accordance with your Executive order of the 20th of that month, I appointed an advisory committee on the subject of printing and publication, as follows: The Assistant Secretary, chairman; the Chief of the Weather Bureau, and the Department Editor, secretary. The rules laid down for the guidance of the committee in the Executive order referred to, conform so closely to the regulations governing the printing and binding of this Department imposed upon the Division of Publications, of which the Department Editor is the chief, that it was not found necessary by the committee to adopt a different system of work or to recommend many changes in the existing orders. The services of the committee were, however, extremely helpful in disposing of many questions submitted to it by the Department Editor, which would otherwise have called for my personal intervention. Up to date the committee has held ten meetings, not at stated times, but at the call of the chairman whenever questions of importance were ready to be submitted to it.

CONGRESSIONAL PUBLICATIONS.

Several important amendments to the law governing the public printing and binding have resulted from the special investigation conducted by the Joint Committee on Printing of the Senate and House. One of these provides that the first cost of all publications known as Congressional publications shall be charged to the printing fund of the Department itself instead of to the appropriation for the printing and binding for Congress, together with the cost of the copies assigned to the Secretary for Departmental use. This has made it necessary, of course, to secure an increase in the appropriation for printing for the use of this Department, and the additional amount estimated, as above made necessary, has been duly appropriated by Congress. This, in reality, is not an increase, but a transfer from one fund to another.

Another amendment provides that public documents ordered printed for Congress may be printed in two or more editions not exceeding in the aggregate the total number authorized by law. This provision applies not only to the number assigned to the use of Congress, but also to the number assigned to the use of the Department. This amendment will doubtless tend greatly to prevent waste by over-publication.

LIMITATION OF APPROPRIATION FOR PRINTING.

A further amendment to the law provides that estimates for the printing and binding of each Department shall be included in a single item, and that after the expiration of the current fiscal year no appropriations other than those made specifically and solely for the printing and binding shall be used for such purposes. In this connection, I desire to place myself on record as strongly favoring the inclusion of the appropriation for printing and binding in the regular appropriation bill for the support of this Department, instead of being, as now, included in a separate appropriation in the sundry civil bill for the general printing and binding of the Government.

INCREASING DEMAND FOR PUBLICATIONS.

The demands for publications continue to increase more rapidly than does the ability of the Department to meet them. The policy followed in the past of continuing the distribution after supplying the regular divisional lists, including libraries, agricultural colleges, and stations, exchanges—foreign and domestic—and persons actively cooperating in the work of the Department, to all miscellaneous applicants until the edition was exhausted, and then ordering a reprint to satisfy further demands, while perhaps the best method to be pursued

in any plan of unlimited gratuitous distribution, was found very unsatisfactory.

In the first place, the funds at our disposal precluded the possibility of unlimited reprints, and thus, while a great many persons were supplied who undoubtedly did not need the publications they asked for, a large number of persons to whom the publications would prove useful were unavoidably left unsupplied, including very often persons whose services to the Department gave them a special claim on us for our publications. Such a plan might have been satisfactory enough in the days when the demand for the Department's publications was not so great, though even then it was wasteful; but at the present time to undertake to supply all miscellaneous applicants—and this is the only fair way if the principle of gratuitous distribution is to obtain—would involve a cost far exceeding any sum which Congress is likely to provide. In the face of the difficulty thus presented to me for solution, I concluded to abandon any attempt at general gratuitous distribution of all Department publications other than Farmers' Bulletins and circulars.

FIRST EDITIONS.

On April 14, 1906, I issued a general order which limited the first edition of every publication to the number of copies necessary to supply libraries, educational institutions, the press, State and foreign officials connected with agriculture, exchanges, and such persons as render tangible service to the Department, either by actively cooperating in its work or as special correspondents, and including a small number to be reserved for emergencies and for use in correspondence, and to furnish a small supply to be placed in the hands of the Superintendent of Documents for sale. I am indebted to the courtesy of this official for the subjoined statement, showing the total number of the publications of this Department sold by him during the last fiscal year and the sums received therefor, and, for purposes of comparison, the total number sold of all Government publications and the amount received:

Publications of Department of Agriculture..........copies..	47, 745
Amount received therefor..................................	$5, 388. 28
All Government publications.....................copies..	75, 828
Amount received therefor..................................	$16, 495. 88

REPRINTS BY THE SUPERINTENDENT OF DOCUMENTS.

I am also indebted to the Superintendent of Documents for a report showing that under the provisions of joint resolution No. 11, approved March 28, 1904, and with the concurrence of this office, as therein provided, 43 reprints of Department publications were ordered by him from the Public Printer during the year ending June 30, 1906, in editions of

from 100 to 1,500 copies, in order to satisfy the requests of purchasers. Under the terms of the resolution referred to, these reprints, which aggregated over 10,000 copies, were paid for from the funds received by the Superintendent of Documents from the sale of our publications. This sale of Government publications under the provisions of the resolution, which authorize him to reprint as occasion requires, defraying the cost of same from the sums received by him as purchase money, affords the most equitable plan for the distribution of these publications to miscellaneous applicants. It involves no waste, meets the requirements of all parties interested at a minimum cost to the Government, and provides for a supply adequate to any possible demand.

To make this system a complete success requires the extensive advertising of the existence of these publications, and to this end this Department supplies each month to all persons desiring it a list of the publications issued during the month previous. By this means, and through the intelligent courtesy of the press, our publications are widely advertised. A second requirement is, in my opinion, that these publications should be sold at cost of paper, printing, and binding, the cost of the first edition, which includes the making of the plates, being properly defrayed by the Government. Another great convenience would be afforded to intending purchasers if the Superintendent of Documents were authorized to receive postage stamps as cash. This is especially true where the sums involved amount to or include fractions of a dollar.

DEMAND FOR PUBLICATIONS BY EDUCATIONAL INSTITUTIONS.

A great many demands are being made upon us by educational institutions for publications of this Department to be used as text-books, and as these demands usually involve supplying whole classes of students with the same publication, the question promises to present some difficulties. Heretofore I have made it a point to grant such requests, but how long I can continue to do so gratuitously, in the face of rapidly increasing demands of this character, is problematical. In many cases, especially where there has been cooperation between State institutions and this Department, the number desired is so great that the parties themselves desire the privilege of purchasing hundreds, and sometimes thousands, of copies.

Under the law regulating such matters the Public Printer is authorized to sell not more than 250 copies to any individual, and the applicant must file his order before the publication goes to press. In the cases I refer to, this number is generally inadequate, and moreover it is impossible to comply with the condition. There is then left to the institution or official desiring the publications the alternative of purchasing the plates, with a view naturally to saving the cost of composi-

tion. Under the law no saving can be effected in this way. The Public Printer is compelled to charge not only the cost of the metal in making the plates, but also the original cost of composition. I would suggest an amendment to the law, authorizing the Public Printer to supply duplicate plates of Government publications at the cost of such duplication, with 10 per cent added for handling, to all applicants duly indorsed by the head of the Department issuing the publication.

BUREAU OF STATISTICS.

SUMMARY OF THE WORK DURING THE YEAR.

The work of the Bureau of Statistics is performed in three divisions: (1) The Division of Domestic Crop Reports, (2) the Division of Foreign Markets, (3) the Miscellaneous Division.

As in former years, the principal work of the Bureau of Statistics has been the collection and dissemination of information regarding the acreage, condition, and yield of the principal agricultural crops of the United States.

The Division of Domestic Crop Reports handles the great mass of reports received from month to month by the Bureau for the use of the Statistician and the Crop Reporting Board in preparing the estimates of the Bureau.

The work accomplished in this Division is supplemented by reports received from salaried State statistical agents, one of whom is located in each State, and from special field agents who travel within and throughout defined territory, consisting of two or more States, examining the crops in the field and securing information for the use of the Bureau from all available sources, such as country bankers, agricultural implement dealers, representative farmers, country merchants, and others.

During the year the scope of this work has been very greatly broadened, the increase being approximately 100 per cent. Twenty-five crops not previously dealt with by the Bureau have been added, concerning which reports of condition are made from month to month. This has taxed the working capacity of the clerical force of the Bureau, and has rendered it necessary that they be required to do considerable work above and beyond the regular hours of service ordinarily required.

The special field service of the Bureau of Statistics, as well as the corps of State statistical agents, has been considerably strengthened and the work of these employees has been placed upon a uniform, scientific basis, such as did not formerly prevail. The reports of the Bureau and the methods employed in making them seem to have met with general approval, and have largely increased the confidence of producers, consumers, dealers, and the public generally in their integrity and accuracy.

In order to prevent the possibility of information regarding the reports of the Bureau being prematurely given out, methods have been adopted which render such leakages impossible. These are explained and described in detail in the annual report of the Statistician of the Bureau. The value of the monthly crop reports of this Bureau has been so thoroughly established that any suggestion looking to their curtailment meets with vigorous objection and opposition from all who are interested in the promulgation of fair, unbiased estimates regarding acreages, conditions, and yields of the products of agriculture.

The Division of Foreign Markets compiles information regarding the imports and exports of all the different classes of farm products; also of manufactured products as far as the output of packing houses can be so denominated. The information thus gathered is published annually in bulletins, to which wide circulation is given. In addition to this regular work, studies are made of conditions in countries competing with the United States in the world's markets, with regard to packing-house products and meat animals, and a large amount of instructive matter has been collected and published.

Investigations have also been conducted by this Division of the world's meat trade; of the comparative healthfulness of meat animals in different countries; of the situation throughout the world with regard to cotton production; of the British market for dairy products and its sources of supply; wheat growing in Russia; freight rates, and the world's production and trade in barley, rye, potatoes, wheat, tobacco, cotton, and other agricultural products.

During the past year a very interesting study was consummated upon the subject of the increase in farm values in the United States, the results of which have been published in bulletins which have attracted wide attention and interest.

In the Miscellaneous Division of the Bureau of Statistics, which embraces the statistical library, the necessary translations incident to the work are made; and a few clerks are engaged in special work, such as the compiling and preparing of material to be used in answering inquiries for agricultural statistics made by Members of Congress and others. The services of the clerks in this Division are called into requisition in the tabulation and computation of the monthly crop reports, or for any other purpose for which they may be required.

An employee of the Bureau of Statistics is stationed in London and from that point makes trips to the different European countries, collecting information regarding crop acreages, conditions, and yields, which he sends to Washington each month for publication in the Crop Reporter, a monthly publication of the Bureau, in which are given the reports of the Bureau, placed in comparison with reports for previous years at the corresponding dates, together with various other statistical information of interest to farmers and dealers in and consumers of farm products.

Much statistical work in the way of tabulation and computation has been done for other Bureaus of the Department, and though the regular work has been greatly increased through the enlargement of its scope, all the statistical service required by other Bureaus has been accomplished promptly and satisfactorily. The work of the Department is being unified and made cooperative in many lines of research and demonstration.

Investigations have been carried on through a series of years regarding the cost of producing farm products, and results of these investigations have been embodied in bulletins, which, it is believed, will be of great value and interest.

THE LIBRARY.

The growth of the Library has exceeded that of any previous year, so that at present the scientists of the Department have available for their use a collection of scientific books, periodicals, and pamphlets numbering over 92,000. All new publications of value relating to general agriculture and to special subjects concerning which investigations are being carried on by the Department have been purchased, over 500 periodicals alone being received regularly. This Library is gradually growing to be the most complete collection of agricultural literature in the country. Many valuable purchases and gifts have been included in the 5,000 additions of the past year. For the advancement of work in connection with food and drug regulations, meat inspection, and game protection an unusual amount has been expended for law books and other works published in this country and abroad relative to these subjects. Every new line of work entered upon by the Department makes a correspondingly new demand upon the Library.

CATALOGUING.

The card catalogue of 160,000 author and subject entries is the most valuable key to the resources of the Library. The cataloguing has been kept up to date, so that the material on a given subject is readily available. Cooperation with the Library of Congress and with other institutions which print cards has enabled the Library to secure a larger number of printed cards for its catalogue than ever before. These cards are not only for books and pamphlets of its own, but many show what may be found on subjects of interest to this Department in other departmental libraries. By this means the scope of the catalogue is largely increased at the least cost of time and money.

The cataloguing of the publications of the Department has progressed from year to year until now there is a card catalogue to these documents up to the latest bulletin issued. These cards are valued by all libraries receiving our publications regularly, affording as they do the only

up-to-date means of reference to all authors and subjects of the publications. On account of the increasing demands for this catalogue and of the lack of space in the library for handling and storing the cards, it has been found advisable to transfer the printing and distribution of cards to the Library of Congress. This cooperation has given satisfactory results in the advancement of the work.

Not only is the Library indispensable in connection with the work of the Department, but much work has been done in it by visiting specialists, and to many agricultural colleges and experiment stations temporary loans of publications not elsewhere to be found in the country have been made.

OFFICE OF EXPERIMENT STATIONS.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The great value of the agricultural experiment stations as agencies for the advancement of agriculture through scientific research was recognized by Congress in a signal manner during the past year by the passage of the Adams Act. This measure, introduced and championed by the late Hon. Henry Cullen Adams, of Wisconsin, had the unanimous approval of the committees on agriculture in both Houses, passed in Congress without a dissenting vote, and received the approval of the President March 16, 1906. It provides that each State and Territory shall annually receive from the National Treasury a grant of money in addition to that given for the establishment and maintenance of agricultural experiment stations by the act of March 2, 1887 (Hatch Act). The initial appropriation to each State under the Adams Act is $5,000 for the fiscal year 1906. To this amount $2,000 is to be added each year for five years, after which an appropriation of $15,000 is to continue annually. Thus in 1911 and each year thereafter each State will receive $30,000, double the amount hitherto granted under the Hatch Act. The new act recognizes the fact that through previous National and State legislation the stations are thoroughly organized, are equipped with lands and buildings, and have funds for the printing and distribution of publications.

The extension and strengthening of the experimental work of the stations is therefore made the sole object of the Adams Act, and the additional funds are "to be applied only to paying the necessary expenses of conducting original researches or experiments bearing directly on the agricultural industry of the United States." The Adams fund is thus essentially a research fund, and if properly used should produce results of the greatest and most permanent value to American agriculture. The State experiment stations have already performed service of great value. They have done much to secure radical and widespread improvements in agricultural practice; they have contributed in large measure to the creation of a new American

literature of agriculture and made it available to every farmer; they have collected much of the material from which a science of agriculture is being formulated as the basis for the instruction of successive generations of farmers in colleges, schools, and farmers' institutes. As their work has developed, it has naturally divided itself into several broad classes, which may be briefly summarized as (1) original research; (2) verification and demonstration experiments, often of a local character and import; (3) inspection service; and (4) dissemination of information. So great has been the local pressure for work of the last three classes that by far the greatest share of the National and State funds has been spent in these lines. The Adams fund now comes in to enable the stations to broaden and deepen their original researches, on the results of which largely depends the success of their other work.

Previous to the passage of the Adams Act the funds of the stations from sources within the States had steadily increased, until in 1905 they exceeded the revenue derived from the National Treasury. There is every reason to believe that the States and local communities will continue to deal liberally with the stations, and that thus they will be able to extend their more popular and directly practical work. The United States will thus have a much more thorough and comprehensive system of agricultural experiment stations.

Congress having put in my hands the administration of the Adams Act, I have assigned to the Office of Experiment Stations the duty of dealing with the experiment stations in matters relating to this act.

The untimely death of Mr. Adams has taken away one of the foremost leaders in the cause of agricultural progress in this country. His clear insight into agricultural problems and needs, his thorough sympathy with farmers, his appreciation of the benefits accruing to agriculture from the work of properly trained scientists, his independence of thought and action, his fearless advocacy of measures which he deemed of importance to agriculture, his experience in public life both as an administrator and as a legislator, his thorough honesty, which won the respect and confidence even of those who opposed him, put him in a position to render the highest and best service in National councils and legislation. In consideration of the important social and economic changes which our rural communities are passing through in these days, as well as of the vast material interests involved in our agriculture, the loss of such a leader is most keenly felt. Great, however, was his achievement in the short period in which he was a member of Congress, for the name of Representative Adams, of Wisconsin, will ever be linked with that of Senator Morrill, of Vermont, and Representative Hatch, of Missouri, as the author of a measure of fundamental and permanent importance to the institutions which advance and disseminate the knowledge on which our agricultural progress and permanent prosperity largely depend.

THE AGRICULTURAL COLLEGES AND SCHOOLS.

In response to demands from numerous sources the work of the Department relating to agricultural education has been gradually broadened, until now it touches nearly every phase of the subject. This Department, through the Office of Experiment Stations, has been active in aiding the establishment of agricultural high schools and the introduction of agricultural subjects into the curricula of the public schools. Representatives of that Office have addressed important educational and agricultural meetings in the interests of agricultural education in a number of States, have given advice regarding legislation and courses of study, and have assisted in the inauguration of agricultural instruction and the securing of agricultural teachers in different localities. The agricultural colleges have been visited and conferences have been held with their officers and teachers. A special study has been made of the agricultural work in the colleges for negroes.

The general interests of higher education in agriculture have been promoted through cooperation with the Association of American Agricultural Colleges and Experiment Stations. As chairman of the standing committee on agricultural instruction, the Director of that Office has aided in studies with reference to the improvement of courses of instruction in the agricultural colleges and schools. He has also acted as dean of the Graduate School of Agriculture, which held a second successful session at the University of Illinois the past summer. The faculty of this school consisted of 35 of our leading agricultural teachers and experts from this Department and the agricultural colleges and experiment stations. The students, drawn from 34 States and Territories, were mainly the younger men already engaged in agricultural teaching and experimenting.

With the development of the Department's work along educational lines it has become clear that it may accomplish important and valuable service as a central agency for the promotion of agricultural education in cooperation with the State departments of agriculture and education, the agricultural colleges and experiment stations, and the State and National agricultural organizations. The most important lines of educational effort in which the Department should engage may be briefly outlined as follows:

(1) To aid the agricultural colleges to reduce the results of the investigations made by this Department and the experiment stations to pedagogical form for use in agricultural colleges and schools of different grades. This work is now proceeding too slowly to keep pace with the accumulation of material, and the lack of well-ordered manuals and illustrative materials is a great hindrance to the effective organization of agricultural instruction.

(2) To promote the efficiency of agricultural instruction in the negro land-grant colleges, in order that the funds granted for negro education by the Federal Government may contribute toward keeping the negro on the farm and making him a more efficient factor in agricultural production for his own good and that of the nation, rather than, as is largely the case at present, drawing him away from the farm into the uncertainties and dangers of city life.

(3) To aid the agricultural organizations in the several States in promoting an efficient organization of agricultural high schools, consolidated common schools, and other educational agencies best adapted to secure a high state of prosperity and contentment in rural life. It is along these lines that the great educational effort of the immediate future is to be made. The forces behind the movement for industrial education have hitherto devoted themselves very largely to the promotion of instruction in the city industries. It is now apparent that a similar work needs to be done for the great fundamental industries grouped under agriculture. Much work will be required to bring the masses of our agricultural population into sympathetic touch with the progressive movement in education and to secure for them a school system in harmony with their environment and their relations to the world's work and civilization. As the nation's representative of agricultural enlightenment and progress, this Department should be in a position to render effective aid in this enterprise, on the success of which depends so largely the permanent prosperity and contentment of our agricultural people.

(4) Since the success of agricultural instruction in the public schools will depend very largely on the teachers, this Department should aid the agricultural colleges and other State educational institutions in preparing and inaugurating training courses for teachers of agriculture in secondary and elementary schools.

(5) Since agriculture as a fundamental industry is of vital importance to all our people, this Department should present such results of its work and that of the experiment stations at home and abroad as are adapted to instructional purposes in connection with nature study and elementary agriculture in a form available to teachers and pupils in both country and city, the object being to impress our youth with the dignity, value, and attractiveness of country life and pursuits.

THE FARMERS' INSTITUTES.

Interest in the farmers' institutes continues to increase throughout the country, and a larger attendance is reported for the past year than ever before. The Department is keeping in close touch with the State organizations under which the institutes are held, and is especially aiding the lecturers to obtain up-to-date information regarding the

progress made in agricultural science and practice. In many localities there is a demand for more extended and definite instruction than can be given in the ordinary institutes. The Department is therefore having short courses of lectures prepared by experts, which may be used in so-called movable agricultural schools. Inquiry is also being made regarding the value of various other means more or less extensively used for interesting farmers and their families in improved practice on their farms and in their households. Representatives of the Department have accompanied the special railroad trains which have carried exhibits and lecturers to thousands of farmers in many parts of the country, proving a popular and effective means of awakening interest in the work of the Department and the experiment stations. The farmers' institutes and other forms of what is often called extension work in agricultural education are very important supplements to the publications of the Department and the stations, as well as to the regular work of the agricultural colleges and schools. The Department should share in this extension work and seek to promote its general interests.

EXPERIMENT STATIONS IN ALASKA, HAWAII, AND PORTO RICO.

A systematic effort has been begun to determine the feasibility of the live-stock industry in Alaska. A small herd of Galloway cattle has been purchased and located at Kenai, in Cook Inlet, and at Wood Island. These cattle have subsisted during the summer upon the native grasses, and a considerable supply of grain hay has been grown at the Kenai Station with which to maintain them during the winter. Wheat, rye, barley, and oats matured in 1905 and 1906 at the Rampart Station in the Yukon Valley, but 300 miles farther south, in the Copper River Valley, cold and drought killed all but the hardiest varieties of cereals. A large amount of grain hay was obtained at the Copper Center Station and sold at a highly remunerative price. It has been shown that many of the Alaskan soils require lime, and a method has therefore been devised for the cheap local production of lime in small quantities. Arrangements have been made to open a station near the prosperous mining towns of Fairbanks and Chena, on the Tanana River, as soon as funds are available for this purpose.

The Hawaii Station reports an increasing appreciation of its efforts toward diversifying the agricultural industries of the islands, and as a direct result of three years' experimental work with tobacco it is said that this year fully 200 acres were planted. The discovery by the station chemist that Hawaiian feeding stuffs are deficient in lime is an important one, and will make it possible to arrange more satisfactory rations for live stock. The investigations on the marketing of tropical fruits promise to open markets in the Pacific coast, which can best be supplied from Hawaii. Investigations begun with the

object of rehabilitating the rice industry have been so favorably received that private individuals have generously contributed considerable sums of money to aid in carrying them on.

The Porto Rico station is extending its influence, and requests for cooperative work are coming from numerous sources. While the income of the station has been too limited to enable it to meet these demands, yet they show a growing sentiment in favor of the station which is very encouraging. The coffee experiments have begun to show results, and the improved methods of pruning and cultivation are quite apparent in the increased yields obtained. A successful effort is being made to grow lowland rice, and this industry should be greatly extended. The Porto Ricans are large consumers of rice, most of which is now imported. Among the forage crops experiments with cowpeas have been most successful, and it is believed that they can be grown throughout the island. Numerous horticultural experiments are in progress, and studies are being made of insect pests and plant diseases.

The work of the stations in Alaska, Hawaii, and Porto Rico is now so well established that they can profitably make use of increased funds. Considering the fact that all buildings, equipment, and live stock must be provided for these stations from the Federal funds, there is even greater need of more liberal appropriations for their maintenance than in the case of the State experiment stations. I therefore recommend that an appropriation be given to the stations in Alaska, Hawaii, and Porto Rico equal to the amount given the State stations under the Hatch and Adams acts.

PROGRESS IN NUTRITION INVESTIGATIONS.

The investigations on the food and nutrition of man, conducted in different States and Territories under the auspices of the Office of Experiment Stations, have, as in the past, been carried on in cooperation with universities and other schools, as well as public institutions, but chiefly with agricultural experiment stations and agricultural colleges. By this cooperation the Department funds have been materially supplemented in various ways and the scope and possibilities of the work greatly increased. The chief object of the investigations is to learn the nutritive value of agricultural products of animal and vegetable origin and the proportions in which such food materials of different kinds may be most intelligently used to the advantage of both producer and consumer. The general policy has been to undertake, in the different centers of investigation, work for which the institution or region offered exceptional facilities. Thus, at the California Agricultural Experiment Station studies have been undertaken with fruits and nuts and the products made from them; at the Minnesota and Maine experiment stations with wheat, corn, and other cereal foods; at the University of Tennessee with cowpeas and other legumes;

and at Wesleyan University, Middletown, Conn., with cheese made and cured in different ways. New experiments have been undertaken whenever the finishing up of any line of work has rendered this possible, and it has been the purpose to select for study especially those problems which have a direct bearing upon agriculture.

The experiments which have been conducted at the California Agricultural Experiment Station have furnished additional evidence of the considerable amount of nutritive material which may be supplied in readily digestible form by fruits and nuts intelligently used as part of the diet. It appears further that fruits and nuts are more useful when eaten in combination with other food materials than in large quantities by themselves or at the end of an otherwise hearty meal.

The studies of cereal breakfast foods undertaken at the Maine and Minnesota experiment stations have shown that different classes of goods made from the same grain do not differ materially in nutritive value though there is a considerable range in price. As a whole, cereal breakfast foods are nutritious and reasonably economical. As regards digestibility they closely resemble bread made from the coarser flours and are somewhat less thoroughly assimilated than bread made from white flour. It has also been shown that flour products other than bread closely resemble bread in digestibility and total nutritive value.

From studies with corn products, undertaken at the Maine Experiment Station, it appears that corn bread of different sorts has about the same digestibility as bread made from coarse wheat flour, and that it is well worthy of a place in the diet as a reasonably inexpensive source of nutritive material, as well as for the sake of variety.

The studies of different methods of cooking meat carried on at the University of Illinois have shown that it is possible to control cooking processes so that a fairly uniform product may be obtained when similar cuts of meat are cooked by either boiling or roasting. As a whole, meats of different kinds and cuts supply nutritive material, particularly protein and fat, in forms which are very well assimilated.

Investigations on the digestibility and nutritive value of cheese carried on at Middletown, Conn., have shown that cheese (American cheddar) is very thoroughly assimilated and is not productive of digestive disturbances as commonly supposed. When desired it may be used in comparatively large quantities as an inexpensive source of protein and energy in the diet. Cheese, being rich in protein and fat, should be combined with cereal foods, fruits, and similar products, which supply an abundance of carbohydrates, and when eaten in considerable quantities should replace rather than supplement such nitrogenous foods as meat, eggs, and dried legumes. The experiments furnish the first extensive demonstration by scientific methods of the high nutritive value of this important dairy product. The great

importance of cheese as a source of protein has not been hitherto appreciated and in a sense its commercial value as a food has lacked satisfactory basis.

The investigations carried on with the respiration calorimeter at Middletown, Conn., have furnished new and valuable factors regarding the average amount of energy in the form of food required by men at rest and performing various kinds of work, the carbon dioxid and energy output at different times of the day under different conditions of work and rest, and related topics.

The investigations undertaken at the Hawaii Agricultural Experiment Station have furnished interesting data regarding the nutritive value of tropical food products and the kinds and amounts of food consumed by persons living under different circumstances in tropical regions.

At Columbia University, New York, the investigations which have been undertaken furnish new and valuable data regarding the demands of the body for the ash constituents of food.

The results of the nutrition investigations are made public by means of technical bulletins and popular summaries, and a great deal of miscellaneous information is also supplied to teachers, students, and other persons by means of correspondence, the increasing demand for publications and other data being an indication of the favorable way in which the work is regarded by the people at large.

Extended use has been made of the nutrition publications as text-books in a large number of schools, colleges, and medical schools throughout the country, owing to the fact that satisfactory text-books on these subjects have not hitherto been available. In this connection it may be mentioned that there are 45 agricultural colleges or similar institutions receiving Government aid for white students, and an equal number for colored people, where some of the courses of instruction necessitate the use of such data.

The proper economical feeding of families or groups—that is, the best methods of utilizing the food products which come from the farm—is a subject the importance of which can hardly be overestimated, and a knowledge of the important facts regarding the nutritive value of different foods can not fail to bring about improved standards of living on farms and elsewhere and benefit alike the producer, the distributer, and the consumer of food products.

IRRIGATION AND DRAINAGE INVESTIGATIONS.

Three years ago the Office of Experiment Stations detailed some of its irrigation experts to work out and introduce the right methods of irrigation in some of the older districts where water is scarce and costly and where skill and economy in its use are of the utmost importance, and also took up giving practical advice to beginners in irrigation in sections where irrigation was being introduced. The conditions

under which these men worked therefore were widely different, but the results have been the same in each case. Wherever this educational work was begun there has been a marked appreciation of its value. Each one of these men has become a fixture in the State and section where he was first located. Every attempt to send him to a different section to take up this work has been met by protests and remonstrances which could not be disregarded. The result has been that requests for similar work in other localities made by Members of Congress, governors, and communities could not be responded to, although the value of the work and the reasonableness of the requests were fully appreciated. To meet these demands the number of men engaged in this work should be increased during the coming year.

Thus far this work has been carried on entirely in aid of settlers under private works, but it is believed that the time has come when this Department should take up the work of educating and aiding settlers under Government reclamation projects, and that experts should be detailed to these projects to show the methods of applying water which should be adopted, the kind of tools to be used, the time when land should be irrigated, the quantity of water which should be used, and the cultivation which should follow this use.

The experience of the past few years has also shown that this educational work and the successful conduct of original investigations can both be best carried on through the establishment of farms where the best methods can be worked out and illustrated and their results demonstrated. While bulletins and reports are of great value, they are not equal to an object lesson. Nothing will teach these farmers how they should do their work so quickly as to be able to see fields prepared in the right way, water handled in the right way, and the soil cultivated in the right manner. I believe therefore that on each reclamation area a demonstration farm should be established, on which the methods of irrigation can be taught by a practical expert from this Department, and trust that provision will be made for this by the next Congress.

Five irrigation extension stations for the demonstration of methods of using groundwater and flood and storm waters in irrigation as supplementary to dry farming have been located in the semiarid belt during the past year. At these stations it is expected to work out and demonstrate the methods and practices for utilizing limited water supplies in the irrigation of from 1 to 10 acres of land, and the methods of irrigation and tillage needed to conserve this moisture in the soil, and the benefits which will come by making such irrigation a feature of every semiarid farm. This work has assumed a new importance because of the great wave of settlement which is now sweeping over this region.

A number of influences, some of them proper and some questionable, are aiding in this settlement. Among those that are legitimate are the greater possibilities due to the introduction of drought-resistant crops, the improved methods of tillage, and the series of wet years with which that section has been favored. But there will come other dry years, and the permanent prosperity of these settlers will largely depend upon their having fortified themselves against the risk of drought by utilizing every opportunity for a water supply that the region affords. Nothing will aid more to enhance their comfort or relieve them from the danger of dry years than to have from 1 to 10 acres of land irrigated where crops can be grown regardless of the rainfall. Provision for such irrigation will enable the farmer to grow trees for fruit and shade, have a limited area of high-priced products, enough vegetables for his family, and forage for his cows and horses. It will also enable him to make the surroundings of his homestead attractive, thus adding to the comfort and contentment of country life in these regions.

That the demonstration farm is an effective influence in promoting the extension of this kind of irrigation has been proven by the results of the oldest of these stations, located at Cheyenne, Wyo. This station, through the utilization of underground waters lifted by windmills, has produced crops equaling those of the old irrigated districts. It has shown the extent and value of water resources hitherto neglected. The station was visited during the year by fully 5,000 people, and its methods and results observed and described in a large number of scientific newspapers and magazines, as well as in the local press of that region. It has encouraged a large number of farmers to conserve and utilize water supplies which were hitherto going to waste, and the year's results are considered as marking the beginning of a new era of agriculture in that section.

In many parts of the arid and semiarid region water for irrigation can be secured only by pumping. The Department has a constant call for information as to the cost of such irrigation and the types of pumps and the kind of power which should be used. We have collected a large amount of information on these subjects, which is now being prepared for publication, and recently have inaugurated some comprehensive tests to determine the value of alcohol as a power agent in pumping water for irrigation and drainage, and in other agricultural work, with a view to giving practical information to farmers about the value of denatured alcohol as compared to gasoline, and the conditions under which it should be used to secure the maximum efficiency.

Every year the area of irrigated land that needs drainage is increased, which proves that irrigation and drainage must go hand in hand. During the past year the Department has been carrying on

extended drainage investigations of some of the irrigated districts injured by surplus water in Utah, Washington, Nebraska, and California, this work been paid for in part by State appropriations. These investigations have been carried on as a preliminary step in the preparation of drainage plans.

The past year has also demonstrated the benefits of good engineering in securing the efficiency of drainage as a remedy for alkali. The drains put in by the farmers of Utah on lands which were regarded as ruined by alkali have so relieved the lands in a single year that they are now ready for cultivation, and land drained three years ago according to plans prepared by the engineers of this Department, this year produced $75 worth of sugar beets to the acre. Equally encouraging results on a larger scale have followed the carrying out of the plans of the Department's engineers in the State of Washington.

The drainage of the swamp overflowed lands in the humid parts of the United States would extend or greatly improve agriculture over an area almost equal to that of the States of Illinois, Indiana, and Ohio. This makes farm drainage a matter of National interest and importance. Nor will the increase in agriculture mark the full measure of the benefits of this drainage. Many of these swamps are a menace to the health of surrounding neighborhoods and a great obstacle to the development of commerce and manufacturing. The reclamation of some of these areas, like the coastal swamps of the Carolinas, the Everglades of Florida, and the St. Francis Basin in Arkansas, presents agricultural and engineering problems of great complexity, which can not be solved by private enterprise; the cost and the area of country involved are both too great. As a rule agricultural drainage requires special legislation to provide for the organization of the district to be benefited and the raising and expenditure of funds under public or semipublic authority. The general interest manifested in drainage in this country, with the large amount of work done at present, has given rise to many important questions, legislative, financial, engineering, and agricultural. The calls on the Department along these lines have been far greater than could be met. During the past year it has rendered important aid by conferences with State officials and others in making surveys and investigations to determine the feasibility of large drainage projects and prepare plans for the work. During the year this Department has carried on these surveys and investigations in thirty-one of the forty-six States.

OFFICE OF PUBLIC ROADS.

Throughout the country, and more particularly in the rural districts, there is a steadily growing demand for information as to the best methods of road construction. Considering the country as a whole,

it is probably true that in no phase of development are we so backward as in the extension of hard and durable roads. In the cases in which the people are willing to expend money on the improvement of their highways, it frequently happens that, owing to inexperience and lack of organization, the money is partially or totally wasted. In some communities abundantly able to support a system of good roads, very little work is done, owing to a lack of knowledge of what can be accomplished with the resources at hand. It is precisely in cases like these that the work of the Office of Public Roads is proving of signal value. While it is no part of the scope of its work to undertake the construction of roads that can be and should be the care of communities within the States, the educational value of employing expert supervision, as well as, to a limited extent, machinery for the construction of sections of improved roads in different parts of the country, has been amply demonstrated.

The act of Congress making appropriation for the Office of Public Roads makes three distinct requirements in relation to the work to be performed, viz, to investigate systems of road administration throughout the United States, to give expert advice on road construction, and to investigate the chemical and physical properties of road materials. During the past year the work of the Office has been arranged in three general divisions along the lines indicated.

The Office is also collecting information as to comparative cost of road work, methods of building various types of roads, State-aid roads, legislation regarding road management, the value of wide tires, the use of convict labor in road building, cost of wagon transportation, and bond issues for road improvement. Numerous inquiries are received asking for information on the subject of the road laws of the various States, and a complete digest of the road laws of all the States is being prepared for publication.

EXPERT ADVICE ON ROAD CONSTRUCTION.

Expert advice on road construction has been given and experimental field work carried on by the Office. There were employed on this work at the close of the fiscal year, in addition to the chief engineer, 3 engineers, 1 consulting engineer, 6 engineer students, 6 road experts, and 5 expert roller operators. Whenever it is possible and where application has been made in the proper way, object-lesson roads are constructed for the purpose of illustrating the best methods of road building. The local authorities furnish all material, common labor, teams, and fuel, the Office supplying supervising engineers and in some cases part or all of the necessary machinery. In addition to this, tests are made to determine the best material

available for the road. It frequently happens that these short sections of object-lesson roads have subsequently led to the construction of fine systems of improved roads in the localities in which they were built. During the past fiscal year 17 roads were built in 11 States, representing a wide diversity in character of construction and kinds of material used.

In many cases in which it is not deemed advisable to undertake the construction of an object-lesson road, engineers and experts of the Office are able to give advice that enables local authorities to improve the conditions and surmount difficulties. It is evident that where only small amounts of money are available for road improvement it is frequently better to improve the highways already existing than to attempt the construction of macadam roads. Special attention has been given to this phase of the work and the Office has been able to do much in developing the use of sand clay and burnt clay for roads in large areas of country, especially in the South, where no stone is available.

In order to give expert advice on special problems which are continually arising in road construction and maintenance, it is necessary to carry on experimental work. During the past year methods of rendering roads dustless have been investigated. The growing use of motor vehicles has presented a new and difficult problem to engineers and road builders. Systematic experiments were carried on at Jackson, Tenn., during the spring and summer of 1905, in cooperation with the city engineer, to determine the value of coal tar for preventing dust and preserving the surface of macadam roads. Tests were also made with Texas oil and its residuums on earth and macadam roads. The expense entailed in these experiments was small. The quantity of tar applied per square yard averaged 0.45 gallon and the cost of labor for applying this quantity of tar was less than 1 cent per square yard. After more than seven months, including the winter season of 1905–6, the tarred roads are still in excellent condition.

Additional experiments were conducted during the summer of 1906 on the Potomac River drive in Washington, D. C., in cooperation with the Superintendent of Buildings and Grounds. Crude coal tar similar to that used at Jackson, Tenn., was used in this work. These experiments have been completed but a short time. The great demand which exists all over the country for some sort of treatment of road surfaces to suppress the growing dust nuisance has developed a number of materials which it is claimed will answer the purpose. Many of these materials, which are mainly emulsions of oil and tar with water, have been given trade names and patented. It is to be hoped that careful experiment will show that some material like crude coal tar, which can be obtained and easily applied wherever there is a gas plant, will prove to be efficient if properly used. It may be said that

a large number of trials of crude tar in France and a few in this country, notably the one at Jackson, Tenn., have given excellent results. In other cases partial or entire failure has followed the experiments, and it yet remains to be determined whether the successful use of materials of this nature can be developed. The Office will make unremitting efforts to solve this problem by such experiments as can be carried on in different parts of the country in cooperation with local authorities.

In order to recruit the ranks of engineers that are necessary to the success of the work of the Office, the plan was adopted of appointing graduates from civil engineering schools to the positions of civil engineer students, as fully explained in the annual report of the Office of Public Roads for 1905. Up to June 30, 1906, nine students had been appointed, at $600 per annum. Of this number three have been given permanent appointments at increased salaries. The other six have not yet completed the one-year course.

A number of schools and colleges have within recent years established summer schools in road building.

INVESTIGATION OF THE PROPERTIES OF ROAD MATERIALS.

During the past year 384 samples were received at the laboratory for routine tests, of which number 273 were samples of rock, intended for macadam road building. Of the 273 samples, about 42 per cent were limestone, 11 per cent dolomite, 10 per cent trap, 8 per cent sandstone, and 8 per cent granite. The remaining samples were of a miscellaneous character, including brick, cements, and sand. Some of this testing work is done in cooperation with various Departments of the Government. A comparison of the demand for tests with the records of previous years shows that it has increased about 33 per cent.

A significant fact, in connection with the laboratory work, is that a very large number of samples have come from the Eastern and Middle States, which have not received much assistance in the form of object-lesson roads. This tends to distribute uniformly the benefit arising from the work of the Office.

There is a growing amount of cooperation between the various State geologists and the Office in the preparation of data showing the character of material suitable for road work in the different States. From one State alone more than 80 samples have been tested. The information thus secured has been used in a bulletin, recently prepared and published by the geologist in charge, on the road-building resources of this State. Chemical and physical examinations have included practically all materials which directly or indirectly come into use in road construction.

The studies of decomposition of various kinds of rock dusts under the action of water, which were undertaken in order to determine the reasons for the important quality of binding power in macadam-road materials, have brought to light some specially interesting facts. For instance, it has been found that by mixing certain rocks of inferior binding power on the surface of the road a much higher binding power results, as in the case of limestone and granite. As the binding or cementing power of rocks is one of the chief factors in the life of a road, the value of this discovery is of obvious importance. These results, originally obtained in the laboratory, have been confirmed by observation and experiment on roads. In the course of this investigation it was found that the decomposing action of water on certain types of ground rocks went much further than had been previously believed to be the case. This applies to the alkalies, and especially the potash, contained in many rocks. The results have suggested the possible use of ground rock as a potash fertilizer. Work along this line has now been turned over to another Bureau of the Department, where it can be appropriately followed up and carefully investigated.

Owing to the numerous complaints of farmers in regard to the rapid deterioration of the modern fence wire in comparison with that manufactured in former years, an investigation of the subject was begun to see what could be done to remedy the defect. Farmers' Bulletin 239 contains a report of this investigation, which has aroused the interest of manufacturers and has determined some of them to take active steps toward producing a fence wire more resistant to atmospheric corrosion.

The scarcity of timber in many sections of the country, not only for construction work, but for fence posts, has in recent years led to a more general use of concrete. This material is admirably adapted for farm purposes, but there seems to be a general lack of knowledge concerning its preparation and use. After a series of tests and investigations, Farmers' Bulletin 235 was issued, giving full information concerning cement, cement mortar, the mixing of concretes, and the construction of concrete sidewalks, driveways, fence posts, etc. A number of persons throughout the country who claim to have obtained special patents on concrete fence posts have attempted to prevent farmers from constructing their own posts by threats of prosecution for infringement. In view of the fact that concrete construction of all kinds reenforced with plain, straight, metal strips, bars, and tubes has been in general use in all countries for many years, the claims of such persons are usually without warrant. The Office has been enabled to be of great service to farmers by making it clear to them that, unless special forms and devices of reenforcement were employed which were

distinctly patentable, no rights were infringed by the use of concrete with plain metal reenforcement.

Before being assigned to work in the field the engineer students employed in the Office receive a course of instruction in the testing laboratory. This work consists in actually making the various tests of road materials and computing results. The information thus obtained is considered necessary in connection with the selection of the best materials for road construction before a thorough understanding of the relations which exist between laboratory tests and the behavior of these materials under traffic can be gained.

A number of new projects and lines of investigation have been mapped out for the immediate future.

Outside of the laboratory a study of road machinery will be undertaken to determine the suitability of various types for different kinds of road work.

Cooperation will be sought with the Geological Survey for the purpose of indicating the various classes of roads on topographic maps issued by the Survey. Cooperation has been begun with the Forest Service in laying out and constructing wagon roads and trails in forest reserves to facilitate lumbering. As a beginning one engineer has been detailed to this work and has been some months in the Yellowstone Reserve. The field report indicates that much good will follow the preliminary survey which has been made.

Cooperation with the Post-Office Department has been begun in order to facilitate rural delivery by the improvement of country roads. This work is of vital importance. The plan, which carries the approval of the Secretary of Agriculture and the Postmaster-General, provides that whenever a road upon which a rural route has been or is about to be established is reported by the carrier or inspector to be impassable or in bad repair, the Fourth Assistant Postmaster-General will advise the Director of the Office of Public Roads of the fact and request that he have an engineer inspector detailed to examine the road and give such advice and instruction to the local officials as may be required.

Upon receipt of such information from the Fourth Assistant Postmaster-General, the Director of the Office of Public Roads will communicate with the local officials and supply them with a copy of the circular of instructions and a blank form for making application for the detail of such engineer inspector. It is not the purpose of the Office of Public Roads to actually construct the road or to make any contribution in money, materials, or labor. In most cases a road is impassable on account of defects which can be remedied by the use of proper methods. The engineer inspector who examines the road will note carefully all such defects and advise as to what steps can be taken to place the road in proper condition without great expense. If prac-

ticable, and if so desired, he may in some cases assume temporary direction of the work for the purpose of instruction.

As the chief aim and purpose of the Office of Public Roads is to bring about a general and uniform improvement of the country roads throughout the United States, a cooperative plan such as the one described above offers the best possible means of achieving positive results in furtherance of that purpose. By this means correct methods of road building and road maintenance will be introduced into practically every section of the country. The engineer inspectors assigned to this work will, in visiting places which have requested assistance of this character, follow an itinerary which will include a number of places in a given territory. This will greatly minimize the expense of each inspection and permit the inspector to cover a much larger territory than would be possible in a special assignment to each place. A beginning has been made during the current fiscal year, and efforts will be made to increase the scope of the work in the future.

EXPENDITURES AND EMPLOYEES.

Congress appropriated $7,175,690 for the maintenance of the Department of Agriculture for the year ended June 30, 1906. This was $1,081,150 more than the appropriation for the preceding year. In addition the Department received from various sources, chiefly sales of products, $15,473.45. At the close of the year there was still unexpended, of the appropriation, $1,175,362.15, nearly all of which will be required to meet outstanding obligations. The unexpended balance for the year 1904 ($55,712.37) was, on June 30, 1906, covered into the Treasury. The account for 1905 was still open. Of the special appropriations aggregating $1,250,000 for new buildings, $642,107.25 had been expended prior to September 10, 1906.

For the current year (ending June 30, 1907) Congress appropriated $9,210,440 for the regular work of the Department. The increase is chiefly due to the broadening of the meat inspection. For that service the permanent appropriation is $3,000,000. The estimated revenues of $700,000 from sales of products of the forest reserves and $780,934.68 available for the new buildings bring the total amount to be disbursed by this Department during the current year up to $10,691,374.68.

The number of persons on the rolls of the Department of Agriculture on July 1, 1906, was, outside of Washington, 4,648; in Washington, 1,594; total, 6,242, showing an increase during the year of 796. Of the total number, more than 1,800 have been on the rolls for six years or longer. In the classified service 917 were promoted in salary and class, and 403 resigned. The total number of deaths during the year was 28.

NEW BUILDING FOR THE DEPARTMENT.

The act approved February 9, 1903, authorizing an appropriation of $1,500,000 for a new building, made possible the beginning of the construction of suitable quarters for the accommodation of the Department's work.

It was very necessary in the new building operations to make arrangements for future requirements, and with this in mind, together with the imperative need for suitable laboratories to carry on the important investigations of the various Bureaus, it was concluded to erect two segments of a building, so arranged that extensions could be provided as required, these segments to be used primarily for laboratory work and to provide fireproof accommodations for the Library. Contracts have been awarded for structures of suitable type and design to correspond with other Government buildings in the city, the base being constructed of granite and the superstructure of white marble.

The work has now progressed, with the exception of the interior finish, to approximately the fourth-floor line, and it is probable that the roof will be on before the winter season. The roofing and closing in will allow the interior work to be carried on during the winter without interruption, which, without unforeseen complications, will insure the completion of operations within the contract time, namely, November 14, 1907, and within the $1,500,000 authorized by Congress. The mechanical equipment work, including the heating and ventilating apparatus, the electric wiring and conduit systems, and the electric elevators, has been started, and these systems will be ready for use at the time of the completion of the buildings.

The estimated growth of the Department, made at the time the appropriation for the new building was approved, has been greatly exceeded. Statistics show that there has been during this period of approximately three and one-half years, exclusive of the Weather Bureau, an increase in the number of employees of from 1,037 to 1,483 in Washington, D. C., making a percentage increase of 43. Further, the space required by this force of employees has increased from 137,963 square feet to approximately 264,000, this being a 99 per cent increase, and the rentals paid from the Department appropriation have increased from $21,700 to $54,408.96, or over 150 per cent.

This rapid increase will require other segments of the proposed buildings to be constructed before the Department will have sufficient and suitable accommodations for its work and before the large amount paid annually for rentals can be substantially decreased.

To carry on the work of the Department in an efficient manner on the lines laid down in the foregoing report has necessitated provision for somewhat increased appropriations. This report will fall short

of its purpose if it has not made clear the importance of the interests the Department is designed to serve, and the necessity for carrying on its work. Moreover, the duties devolving upon it are imposed upon it by law, and it is with full appreciation of these several considerations that estimates for its expenses must be viewed. The estimates for the ensuing year have been most conservatively prepared, based upon the lines of work imposed upon the Department by the Congress, and I earnestly commend them to the favorable consideration of that body.

Respectfully submitted.

JAMES WILSON, *Secretary*.

WASHINGTON, D. C.,
November 24, 1906.

NEW PROBLEMS OF THE WEATHER.

By Willis L. Moore, W. J. Humphreys, and O. L. Fassig,
Of the Weather Bureau.

A knowledge of the coming weather enters so intimately into every contemplated human action that the question is often asked: What are the prospects for further improvement in the accuracy of weather forecasts, and can the seasons ever be foretold? The answer is that, while the Government has a corps of forecasters who are now applying all of the knowledge of the atmosphere that has been revealed, little hope for material improvement in their work can be held out until a substantial addition is made to the pure science of the problem. This can only come through experiment, study, and research. With 200 stations engaged in applying the science, it is a wise economy to devote at least one of them to the work of adding to the knowledge that is now costing us nearly a million and a half dollars annually to apply. Accordingly, those in charge have endeavored to lay out a plan of study and research leading to an increase in our knowledge of the laws governing the atmosphere such as should eventually enable our successors, if not ourselves, to add to the accuracy of weather forecasts and to make them for a longer period in advance.

THE MOUNT WEATHER RESEARCH OBSERVATORY.

In order that this country may do its share toward the advancement of meteorology along the lines that specially relate to conditions in America, it is imperative that the Weather Bureau should establish an observatory for its own special research work. A piece of land has therefore been secured and work has been inaugurated at an establishment that is intended to respond to the present and prospective needs of meteorology. This establishment is called the Mount Weather Research Observatory, and is organized on a broad and elastic basis, so that it may from year to year expand with the growing knowledge of our needs. (See Pls. I–III.)

STUDY OF THE UPPER ATMOSPHERE.

In order to prosecute the researches contemplated at Mount Weather, a plant has been established there especially adapted to the investigation of the physical condition of the atmosphere at great elevations above the surface of the earth. Hitherto our knowledge of the

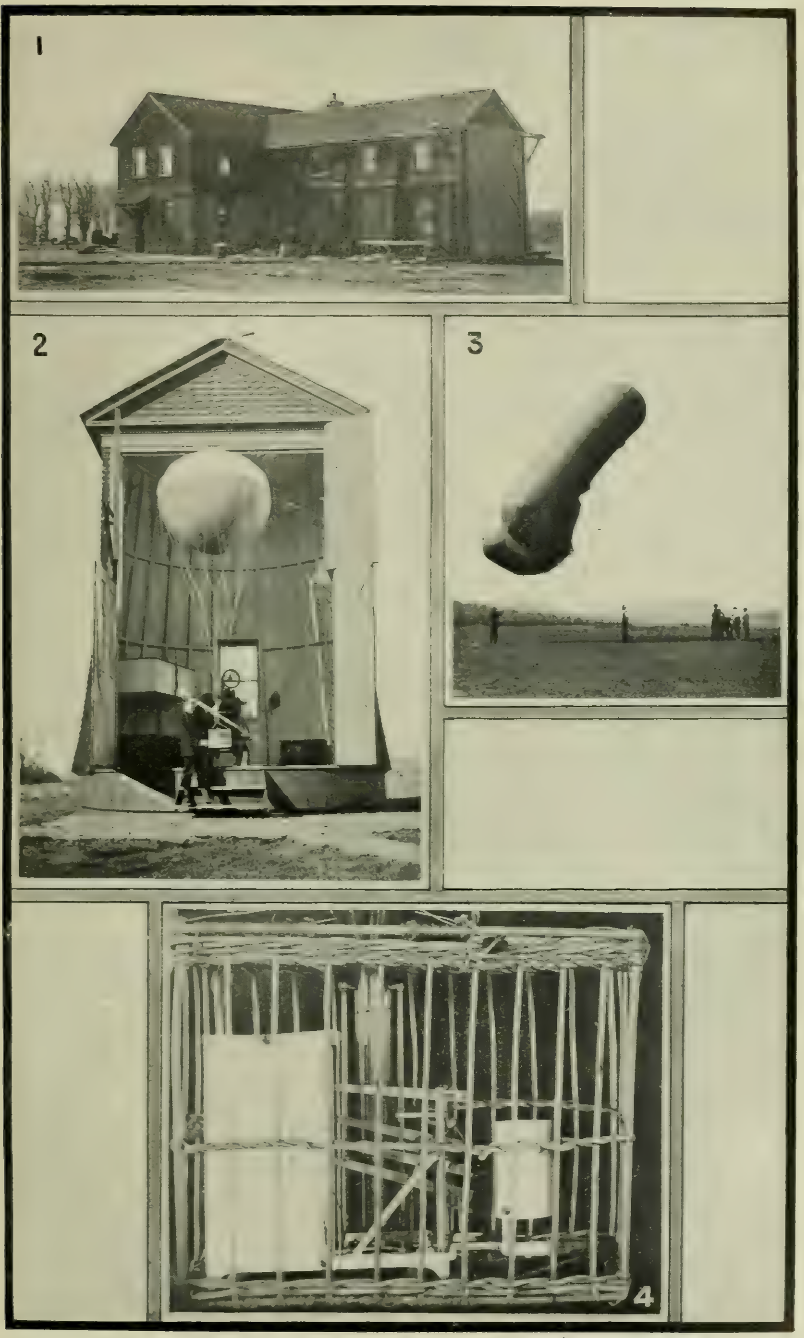
conditions of temperature, pressure, humidity, and wind velocity and direction has been based upon observations made at or near the surface of the earth or upon mountain peaks. Current conceptions of the laws of storms and of the general circulation of the atmosphere are based upon such observations almost entirely. Records obtained in recent years by means of balloons have demonstrated the existence of hitherto unsuspected variations and contrasts in temperature at very great elevations, and have shown that observations on mountain tops and at equal elevations in the free air vary widely.

The necessity for a better knowledge of temperature conditions at great elevations has directed the minds of many meteorologists to the study of the best methods for lifting self-recording instruments high above the earth's surface. The result has been the invention in recent years of ingenious forms of kites and of specially designed balloons for this purpose. The kite has again become an instrument for scientific research, and now enables us to bring down records of atmospheric conditions at elevations of 2 and 3 miles, and even of 4 miles, as was recently demonstrated at the German aeronautical observatory near Lindenberg. By means of small rubber balloons, marvelously light self-recording instruments have been carried up to the remarkable heights of 10 to 15 miles, bringing back records of low temperatures and high wind velocities which have been a revelation to meteorologists—records which are compelling a reconstruction of existing ideas concerning the dynamics of the atmosphere.

Pioneer work along these lines was begun some years ago by means of kites, both at Weather Bureau stations and, under the direction of Mr. A. L. Rotch, at the Blue Hill Observatory, near Boston, Mass. By experiments begun at St. Louis at the time of the World's Fair in the summer of 1904, Mr. Rotch also initiated the practice in this country of sending up small rubber balloons.

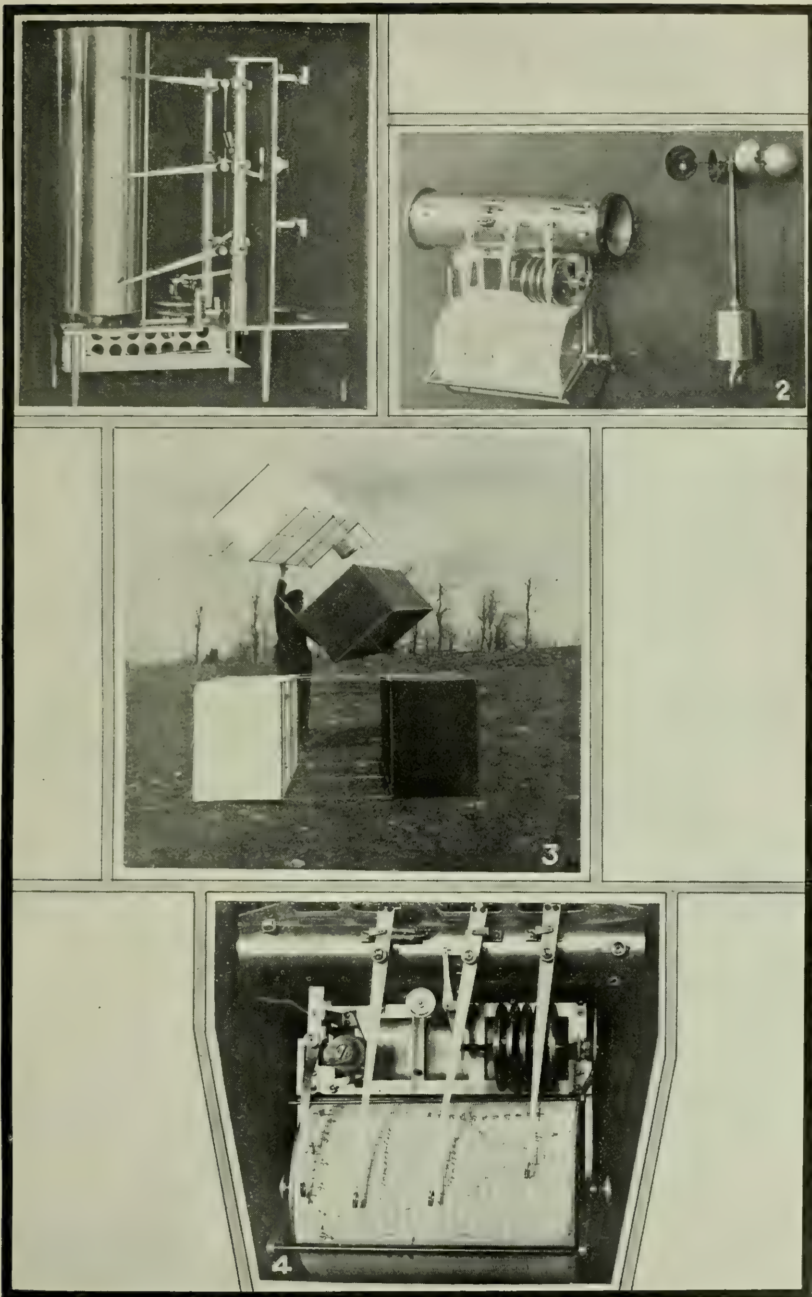
The observatory at Mount Weather is now well equipped with the necessary plant for carrying on this new and promising work of aerial research, and has for nearly a year been cooperating with European institutions and with the Blue Hill Observatory in sending up, on prearranged days, kites or captive balloons. These kites may be raised in winds varying from 10 miles per hour to 35 or 40 miles at the surface. With winds of less than 10 miles per hour it is necessary to employ captive balloons. To attain great heights small free rubber balloons of 2 or 3 cubic yards capacity, called pilot balloons, are employed. The instruments carried by the kites and balloons vary in weight from 1½ to 3 or 4 pounds and record variations in the temperature, the pressure, the humidity of the air, and the wind velocity.

The balloons are filled with hydrogen gas in order to secure the greatest lifting power. This necessitates the use of special apparatus for the manufacture of hydrogen. At the Mount Weather Research



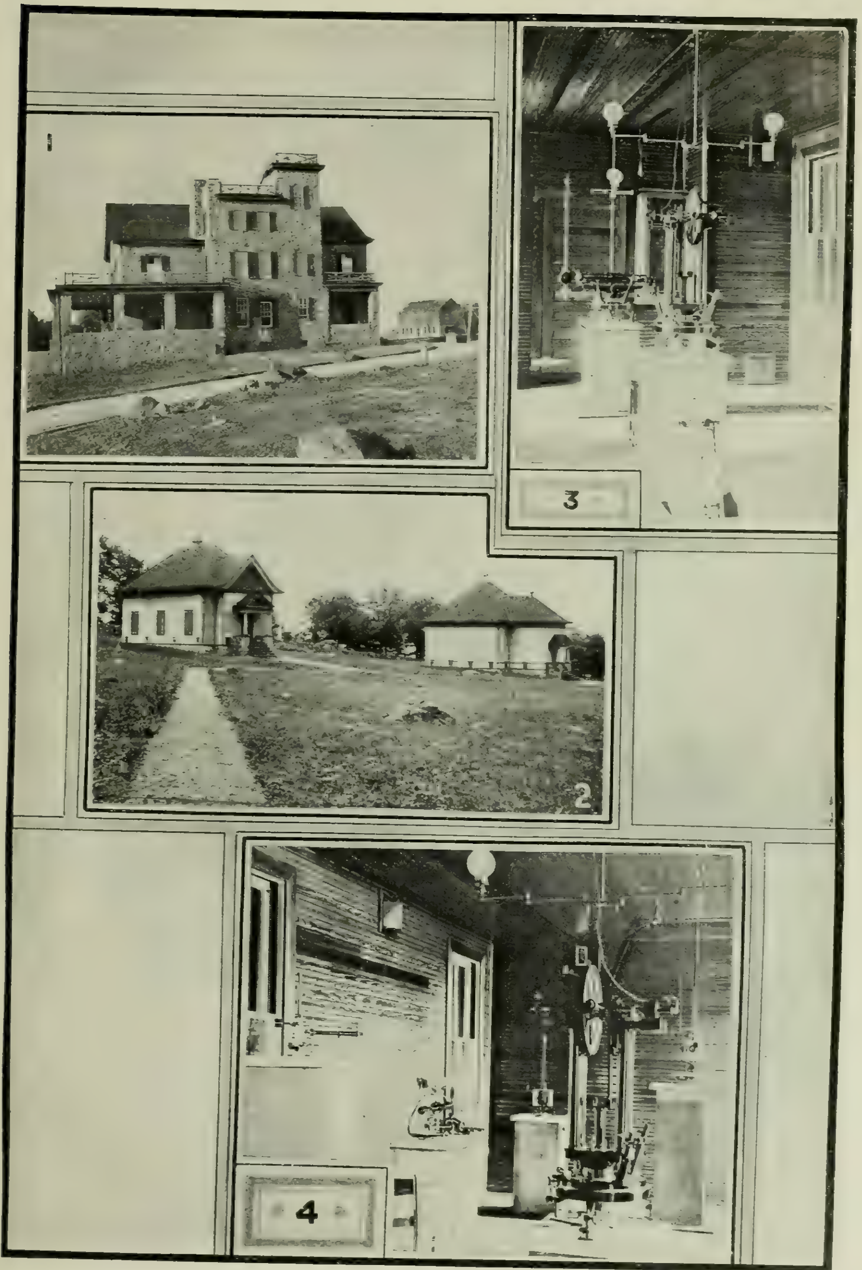
BUILDINGS AND APPARATUS AT MOUNT WEATHER, VA.

[1.—Power house and balloon shed. 2.—Revolving kite and balloon shed. 3.—The Siegsfeld kite balloon. 4.—Hergesell balloon meteorograph in protecting basket.]



APPLIANCES IN USE AT MOUNT WEATHER, VA.

[1.—French balloon meteorograph. 2.—Marvin kite meteorograph with anemometer. 3.—Hargrave-Marvin box kites. 4.—Marvin meteorograph, with record.]



BUILDINGS AND INSTRUMENTS AT MOUNT WEATHER, VA.

[1.—Administration building. 2.—Magnetic observatory buildings. 3.—Interior of magnetic observatory—magnetometer and indicator. 4.—Interior of magnetic observatory—declinometer and theodolite.]

Observatory a strong electric current is passed through water, breaking up the liquid into its constituent elements of hydrogen and oxygen. These gases are then collected and stored in appropriate tanks for future use as occasion may require.

As the small pilot balloons carry up their instruments to heights of many miles, where the prevailing temperatures are at all times very low (sometimes exceeding 100° Fahrenheit below zero), it is necessary to test the accuracy of the thermographs at these low points. For this purpose the observatory is equipped with a plant for the manufacture of liquid air, by means of which the instruments may be tested to the lowest points likely to be reached at great elevations.

In the near future these small rubber pilot balloons, carrying with them to elevations of 30,000 to 50,000 feet the light self-recording instruments referred to, will be liberated simultaneously at 20 to 30 Weather Bureau stations surrounding typical storm centers. Observations obtained in this manner at various elevations when compared with the records made at the same time at the surface of the earth will doubtless throw much new light upon the mechanism of storms, cold waves, etc., and give to meteorologists a better understanding of the general circulation of the atmosphere.

STUDY OF RELATIONS BETWEEN SUN AND WEATHER.

As one of the primary objects in view in establishing Mount Weather Observatory is to make a study of the relations existing between the various forms of solar radiation and terrestrial weather conditions, much attention has been given to the instrumental equipment and to securing men to study the variations in the amount of heat energy given off by the sun from day to day and variations in the amount of heat absorbed by the atmosphere. Some work along these lines has already been done; but a special building and instruments will soon be necessary for the study of these important problems of solar physics.

At present the most sensitive index of changes in solar energy is the suspended magnet. There is no doubt that changes in the intensity and direction of the magnetic force as registered at the earth's surface are coincident with the appearance and disappearance of certain well-recognized periodic phenomena observed on the face of the sun. It is fortunate that we have in the magnetism of the earth a terrestrial element which varies in delicate sympathetic relation with the activities of the sun and is at the same time subject to continuous observation and registration. To appreciate the value of terrestrial magnetism as a faithful index of the state of the sun it should be understood that not only are there regular ebbs and flows of magnetic force in response to the sun's annual approach and recession, his axial rotation and daily passage through the heavens, but even the outburst of a solar spot is simultaneously announced by a disturbance of the earth's magnetism.

So important to the study of the sun is a continuous record of the magnetic variations that one of the first steps in the establishment of the observatory was the installation of a magnetic plant consisting of the best modern instruments for the direct observation and for the continuous registration of the variations in the magnetism of the earth. The standard observatory instruments, both for continuous registration and direct measurement, are of the type devised by Wild for the model magnetic observatory at Pavlovsk, Russia. These are supplemented by a set of Eschenhagen magnetographs, the extreme sensitiveness of which peculiarly fits them for recording minute fluctuations of the earth's magnetic force.

The principal application of the results of the observations will be to supplement the direct observations of the sun, and thus to carry on the record of the solar activity continuously day and night in all conditions of weather. Researches will also be carried on to determine the existence and measure the extent of probable direct relations between meteorological disturbances and magnetic variations. The magnetic records will also be specially studied in conjunction with the results of observations of the radioactivity and the electrical condition of the air, particularly during thunder-storms and at times of auroral displays, for the purpose of revealing their relation to meteorological conditions.

EXPERIMENTAL PHYSICS.

The physical laboratory is not yet completed, and consequently it has not been possible to undertake investigations here in experimental physics. However, through the kindness of the authorities of the University of Virginia a good deal of spectroscopic work has been done at that institution. Some of the results have been published in the Astrophysical Journal, and there are many data yet on hand to be worked up at the earliest opportunity. An investigation, by the aid of a large telescope, of the causes and meteorological relations of the scintillation of stars is in progress at the University of Virginia along lines suggested by one of the Mount Weather officials. A special photometer has been devised for the purpose of measuring the relative densities of clouds, particularly when the entire sky is covered. As soon as the laboratory is completed and equipped investigations will be begun on atmospheric electricity, its origin, distribution, and laws, the causes and nature of precipitation, heat and light absorption, and other physical phenomena of importance to the meteorologist.

THE PRESENT STATUS OF THE NITROGEN PROBLEM.

By A. F. Woods.

Pathologist and Physiologist and Assistant Chief of the Bureau of Plant Industry.

INTRODUCTION.

One of the greatest problems in the maintenance of soil fertility for the maximum production of crops is how to secure and keep a sufficient supply of available nitrogen at the least cost. For most of our arable lands it is now pretty well agreed that this is a problem of bacteriology, with the soil as a culture medium. As in most other great problems, nature and practical experience have pointed the way to its solution. Many of the standard practices of cultivation, crop rotation, etc., which have developed from experience have very important relations to bacterial action in the soil. In fact, the true relation of many of these practices can be understood only from the standpoint of bacterial activity. It remains for science to explain, systematize, and improve practice, placing conditions more accurately under our control. The sources of nitrogen supply are, first, the nitrogen already contained in soils; second, that supplied to the soil by the decay of organic matter; and, third, the fixation of atmospheric nitrogen.

THE DIRECTLY AVAILABLE NITROGEN CONTENT OF SOILS.

The nitrogen in soils is of two types: (1) The ammonia, nitrites, and nitrates, in which forms it is available to crops; and (2) the nitrogen locked up in organic matter and not directly available. The nitrate nitrogen (nitrogen in the form of nitrates) is in most soils present only in small quantity. This supply is quickly taken out by crops or washed out by rains, and if it is not renewed by the action of certain bacteria on the nitrogenous organic matter in the soil or from the atmosphere by other bacteria it must be added directly as nitrate of soda or nitrate of potash, or some other manure must be used containing directly available nitrogen. Manures containing directly available nitrogen are very expensive. The best of these is nitrate of soda, and at the present rate of use the known supply will be exhausted in less than fifty years. More than 1,543,120 tons were used in 1905. Prof. Sylvanus P. Thompson has reiterated in a

recent address[a] the prophecy of Prof. William Crookes, that we shall have a wheat famine unless the yield per acre, averaging for the whole world 12.7 bushels, can be increased. He believes with Crookes and many others who have studied the question carefully that the supply of nitrates is the most important factor in the situation, and it is important not only for wheat but for all other crops. We are not, however, as Professor Thompson seems to believe, dependent on the electrical method, briefly discussed later in this paper, for obtaining this supply. The larger part of the nitrogen required in agriculture is now and will always be obtained from the atmosphere through the agency of certain soil bacteria. By careful study of these organisms and their requirements we can greatly increase their activity. The electrical method, however, will be useful in supplying a part of the immediately available nitrate needed in intensive agricultural operations.

THE DECAY OF ORGANIC MATTER.

The organic matters which are added to the soils in manures and in vegetable and animal remains must go through certain processes of decay before the plant foods they contain become available to crops. Bacteria and fungi of various kinds are the active agents which bring about these changes. Decay is not a simple process, the same in all places and under all conditions. The process varies when the same materials under the same conditions are acted upon by different organisms or groups of bacteria which produce it.

In general, organic materials contain two classes of compounds: (1) The nitrogenous or albuminoid compounds, like flesh and blood of animals and the protoplasm of plant cells; and (2) the nonnitrogenous compounds—the carbohydrates (such as sugars, starches, and cellulose) and the hydrocarbons, as fats. The first class contains the nitrogen formerly taken from the soil as nitrate by some plant, but which in its highly organized form is unavailable to crops until converted into ammonia or nitrate again by certain bacteria. The compounds of the second class serve as food for certain bacteria which are able to obtain their nitrogen from the air and will be discussed later.

The highly organized nitrogenous materials above mentioned, in soils containing a good supply of phosphates, potash, carbonate of lime, and air, moisture, and the right kinds of bacteria, are first modified or digested into soluble peptones by a class of bacteria which secrete a peptonizing ferment. *Bacillus tumescens* Zopf, *B. ellenbachiensis* Caron, *B. mycoides* Flügge, etc., are good examples of this

[a] See Nature, vol. 73, p. 555, 1906.

class. These peptonized products (peptones and albumoses) are then converted into ammonia through the action of these same species and other ammonifying bacteria. The ammonia may then be converted into nitrite by another class of bacteria, principally *Nitromonas europæ,* widely distributed in Europe, and by species of Nitrococcus, said to be peculiar to the soils of America and Australia.[a] The nitrite is then oxidized to nitrate by still another kind of bacterium, Nitrobacter.

On the other hand, if the soil is poorly aerated or deficient in moisture, lime, or other mineral plant foods, the course of this digestion or decay of organic matter is modified. Acids accumulate, and the bacterial action is largely replaced by that of fungi and forms of bacteria that can grow in the presence of acids. The organic matter becomes more or less pickled or humified. The more active forms of peptonizing and ammonifying bacteria and the nitrifying forms are suppressed by the conditions unfavorable to their development. Peaty soils represent the extreme of this type. In the improvement of such soils the great stores of nitrogen and carbon of the humus may be made available by the addition of the mineral foods if they are lacking—especially carbonate of lime or potash—by proper aeration, and finally by the addition of the peptonizing, ammonifying, and nitrifying bacteria. In the present state of our knowledge the last is best accomplished by spreading a few hundred pounds per acre of good, naturally rich, well-worked loam, which usually contains these bacteria. Care should be taken, however, to secure this inoculating soil from fields known to be free from serious weeds, insects, and plant-disease organisms. It is to be hoped that our knowledge of soil bacteriology will develop in the near future to the point where we will be able to determine by bacterial analysis what organisms are present in a given soil and what bacteria are needed to raise the bacterial activity to the highest state of efficiency, assuming of course that the proper conditions for their growth have been supplied. Briefly, these conditions are a warm temperature, good aeration brought about by thorough and frequent cultivation, proper moisture conditions, also favored by thorough and frequent cultivation, good drainage, and a good supply of decaying organic matter, carbonate of lime, phosphates, and other mineral foods.

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[a] Hall, Alfred D. The Soil, p. 72, 1903.

The following table, taken from Bulletin 65 of the Delaware College Agricultural Experiment Station, by F. D. Chester, shows the varying activity of some of the bacteria here under discussion:

Chemical functions of certain soil bacteria.

Species and culture.	I. Liquefaction and peptonization of media.			II. Ammonifying coefficient.	III. Reduction of nitrates to nitrites.	IV. Acidifying coefficient.	
	Gelatin.	Blood serum.	Milk.			Dextrose broth.	Saccharose broth.
Bacillus tumescens Zopf:							
Culture I	++	+	+	1.2	–	1.66	1.85
Culture 5139	++	+	+	1.6	–	1.66	2.85
Culture 5170	++	+	+	2.3	–	2.57	3.00
Culture 5188	++	+	+	3.0	–	1.57	1.40
Culture 5201	++	+	+	4.2	–	....	....
Bacillus ellenbachiensis Caron:							
Culture I	++	+	+	10.0	+	2.55	2.80
Culture 5167	++	+	+	25.0	+	2.44	3.00
Culture 5200	++	+	+	25.0	+	3.06	1.55
Bacillus alcaligenes Petruschky var. *pulvinatus* Chester	–	–	–	Trace.	+	0	0
Bacillus alcaligenes var. *delawarensis* Chester	–	–	–	13.0	–	0	0
Streptothrix soli Chester	+	–	–	5.0	–	0	0
Streptothrix brown sp. indt	–	–	–	5.0	–	0	0
Bacillus mycoides Flügge	+	+	+	12.0	+	2.22	2.71
Bacillus adhaerescens Ford	–	–	–	2.3	+	1.80	1.80
Bacillus gracilis Zim. (?)	+	–	–	10.0	–	0	0
Bacillus sp. indt.:							
Culture 5140	++	+	+	10.0	–	1.77	1.30

In this table a single plus sign (+) indicates feeble or slow activity, a double plus (++) indicates a strong activity of the kind indicated at the head of the column, and a minus sign (–) indicates no activity of the kind. The figures in column II indicate the relative ammonifying activity, and those in column IV the acidifying activity. One important deduction from this table is that the different species vary widely in their ability to accomplish certain work and that cultures of the same species vary greatly. There is therefore opportunity to increase bacterial efficiency in a soil by selection and introduction of the most effective species and the most effective strains of these species, and to reduce in number the inefficient and injurious species. The mere making of conditions favorable to a beneficial or desired species is not sufficient to insure its development unless there is a large number of individuals of the desired species present. There are many species of bacteria—good, bad, and indifferent—that can develop under the same conditions, just as there are many weeds that grow vigorously under conditions favorable to crops. It may be

necessary in some cases to reduce the number of these forms. It is essential that an accurate knowledge be gained of *all* the organisms occurring in various soils, the changes that they produce, their symbiotic and antagonistic relations and the conditions affecting them, and the relation of their activity to crop production. Chester[a] has suggested a very good method for accomplishing this in a uniform manner. A few examples of some of his determinations of bacterial or zymotic efficiency of various soils will be instructive.

A soil from the experiment station garden, Newark, Del., consisting of a heavy clay loam which had been brought to a high state of fertility by plowing under crimson clover for a number of years and kept under active tillage, gave the average results of two analyses as follows:

	Per gram of dry soil.
Streptothrix soli	1,600,000
Bacillus tumescens	1,200,000
Bacillus alcaligenes var. *delavariensis*	330,000
Total	3,130,000

As shown in the table on page 128, *B. tumescens* is the only one of these organisms that can convert nitrogenous matter into peptones with any degree of energy. The relative ammonifying power of these organisms is proportionate to the ammonifying power of the individual organism and to the number of organisms. On this basis this soil has a relative ammonifying efficiency of 13.73 and an acidifying efficiency of 2.22.

Nearly a year later (April 11, 1903) an examination of this same soil showed a great reduction in the number and activity of the bacteria present:

	Per gram of dry soil.
Streptothrix soli	20,000
Bacillus tumescens	745,000
Bacillus alcaligenes var. *pulvinatus*	20,000
Bacillus ellenbachiensis	170,000
Bacillus mycoides	20,000
Streptothrix sp. indt	319,000
Total	1,294,000

The relative ammonifying efficiency of the soil at this time was determined to be only 2.48 and the total acidifying efficiency 1.81. The bacterial or zymotic efficiency of this soil is therefore much lower than it was at the first examination.

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[a] Bul. 65, Del. Col. Agric. Exp. Sta.

On May 11, 1903, a sample of soil from sandy land which had been brought into a good state of fertility was examined, with the following results:

	Per gram of dry soil.
Bacillus ellenbachiensis	140,000
Bacillus alcaligenes var. *delawariensis*	380,000
Bacillus fluorescens	20,000
Total	540,000

The relative ammonifying efficiency is 8.9; the acidifying efficiency only 0.58. It is interesting to note that the bacterial efficiency of this soil is nearly three times as great as that of the station soil at the second examination, though the latter contained approximately three times the number of bacteria. This is explained by the great efficiency of *Bacillus ellenbachiensis.*

Nitrification and nitrogen-fixing activity can be determined and expressed on a relative basis in a similar manner. The addition of available nitrogen to soils through the decay of nitrogenous matter can never exceed or even approximate the amount taken from the soil in the production of that organic material. It represents a gain in nitrogen only in the sense that it is saved. It is not desirable that its conversion into soluble form should much exceed the demands of the crop; otherwise it may be lost. It is evident, however, that with the great waste of organic matter which must inevitably go on we must have other sources of nitrogen to cover the loss and meet the rapidly increasing demand for it, not only in agriculture but in other arts.

THE FIXATION OF ATMOSPHERIC NITROGEN BY SOIL BACTERIA.

Leaving, now, the question of the changes in the nitrogenous organic matter in the soil, we will consider the fixation of atmospheric nitrogen by a class of bacteria that uses the carbohydrate constituents (sugar, starches, cellulose, etc.) of the vegetable matter in the soil. There are two classes of bacteria that can fix atmospheric nitrogen: (1) Those that are not associated with any particular crops, and (2) the root-nodule forms associated principally with legumes. The first group depends on the carbohydrate material in the organic matter of the soil derived from decaying vegetation or from certain minute algæ (the Cyanophyceæ or blue-green algæ). The second group depends principally on the carbohydrates supplied by the plants in the roots of which the bacteria are growing. The latter class will be considered later.

The independent soil forms are widely distributed and belong to several genera. A very good comparison of some of these has been made by Chester, and is shown in the table on the following page taken from Bulletin 66, Delaware College Agricultural Experiment Station.

Gains of nitrogen in nitrogen-poor media by certain nitrogen-assimilating organisms.

Species of organism in culture.	Duration of culture in days.	Milligrams of nitrogen per 100 c. c. of uninoculated medium (blank).	Milligrams of nitrogen per 100 c. c. in culture.	Gains of nitrogen in culture in milligrams per 100 c. c.	Percentage of gain of nitrogen.*
Alfalfa root-tubercle organism pure culture	14	0.600	1.200	0.600	100
Do	40	.532	2.002	1.470	276
Do	15	.490	1.484	.994	203
Do	30	.578	2.450	1.872	324
Bacillus tumescens	16	.446	1.490	1.044	234
Do	28	.446	1.600	1.154	259
Pseudomonas fluorescens var. *nonliquefaciens*	16	.400	1.710	1.310	327
Do	28	.400	1.720	1.320	330
Bacillus candicans	15	.490	1.372	.882	180
Do	20	.578	1.542	.964	167
Do	28	1.00	2.12	1.12	112
Bacillus alcaligenes	15	.490	1.172	.682	139
Do	30	.578	2.940	2.362	401
Do	28	1.00	1.87	.87	87
Bacillus ruminatus	28	1.00	1.81	.81	81
Bacillus fluorescens	28	1.00	1.87	.87	87
Bacillus aurantiacus	28	1.00	2.25	1.25	125
Azotobacter with—					
Bacillus aurantiacus	15	.490	1.642	1.162	237
Bacillus salmoneus	30	.578	1.890	1.312	227
Azotobacter with—					
Bacillus candicans	15	.490	1.792	1.302	266
Bacillus aurantiacus	30	.578	2.556	1.978	342

* The figures in this column are about 100 less than those given in the bulletin cited, and show the actual per cent of gain in nitrogen.

In warm, well-aerated soils containing sugars, starches, and cellulose from decaying grasses and other vegetation, and well supplied with carbonate of lime or other bases and mineral foods, these bacteria fix considerable atmospheric nitrogen. The amount, of course, depends upon the nature and amount of carbohydrate food available, the species present, their number, and the degree of favorableness of the other factors mentioned. In ordinary cultivated soils the supply of available carbohydrate materials is the factor that usually limits free-nitrogen fixation. The almost complete removal of crops leaves very little carbonaceous food for these bacteria. To stimulate the development of these bacteria, assuming that they are present, it is essential that considerable carbonaceous matter be incorporated into the soil.

In grass lands and in wild lands generally, where much of the carbonaceous matter produced finally becomes incorporated with the soil, the fixation of atmospheric nitrogen by the Azotobacter group[a] and the

[a] Beijerinck, who described these forms, holds that Azotobacter can fix atmospheric nitrogen only in association with other forms, such as Granulobacter and Radiobacter. This point, however, is not yet definitely settled. It is settled, though, that these forms working together fix nitrogen much more actively than when they work independently.

other independent nitrogen-fixing bacteria is very great. An examination of two fields at Rothamsted which had run wild for more than twenty years showed an accumulation of nitrogen of approximately 45 pounds per acre per annum in a field poorly supplied with carbonate of lime, and 98 pounds per acre per annum in a field well supplied with carbonate of lime. Bacteriological tests of these fields showed that Azotobacter was present in much larger numbers and had greater powers of fixation in the field containing an abundance of carbonate of lime.[a]

This has been going on in connection with, but entirely independent of, nitrification for ages, wherever the conditions are favorable and the proper bacteria are present. This is true especially of prairie soils in all parts of the world. The work of these organisms represents an absolute gain in available nitrogen. It is highly essential that we should learn more about them and get better control of their activities for the benefit of agriculture. An attempt has been made to do this in the preparation of "Alinit," which is a culture of *Bacillus ellenbachiensis*. This is, however, a species of very small, if any, nitrogen-fixing power. It is of more value as a peptonizer and ammonifier. When it has given good results it has probably been where it was needed for such work rather than nitrogen fixation. Success in the use of cultures can come only when bacteria of high efficiency are selected for a particular kind of work, and are used under conditions favorable to their development and where examination indicates that they are needed. A few failures due to imperfect knowledge must not discourage workers in this important field. Excellent work is being accomplished in the study of these forms in this country, especially by Voorhees and Lipman, of the New Jersey station, and Chester, of the Delaware station.[b]

ROOT-NODULE BACTERIA.

The bacteria of this class, like the Azotobacter group, are able under favorable conditions to fix more or less atmospheric nitrogen independent of legumes. They reach their highest efficiency, however, when growing in the roots of legumes (clovers, alfalfa, peas, beans, etc.), where they usually form nodules. The origin of the species is possibly from a soil form, Radiobacter, commonly growing in association with Azotobacter.

The value of leguminous crops as soil improvers has been well known for centuries, and they are regularly used for this purpose, especially in the older agricultural countries. It is, however, only since the work of Hellriegel and Wilfarth in 1888 that it has been

[a] Science, new series, Vol. XXII, p. 455.

[b] See Bul. 180, N. J. Agr. Exp. Sta., and the station reports for 1903 and 1904; also the Delaware station bulletins previously referred to.

universally recognized that the ability of these crops to grow in soil devoid of nitrogen is due to the presence of certain bacteria in the root nodules. These bacteria have been carefully studied by many investigators in Europe and in this country, and much valuable information has been secured regarding them. The literature of the subject has been reviewed so many times in various publications that it is not necessary to go over it again.[a]

It has been amply demonstrated, not only by hundreds of years of actual experience but by numberless carefully conducted experiments in many countries and under widely varying conditions, that clovers and numerous other legumes supplied with tubercle bacteria obtain from the air through the agency of these bacteria, under favorable conditions, all the nitrogen they require, and that they leave in the soil considerable quantities for succeeding crops. In Germany the amount of nitrogen added to the soil by legumes, besides that taken off in the crop, is estimated at 200 pounds per acre. In the United States the average for sixteen States is 122 pounds, equivalent to not less than 800 to 1,000 pounds of nitrate of soda per acre.[a] These effects, of course, are secured where the conditions for fixation are favorable, viz, where the soil is abundantly supplied with nodule bacteria of high efficiency and where the available nitrogen content of the soil is low and the soil is well supplied with carbonate of lime or its equivalent, and when the phosphates and other elements of available plant food are present in sufficient quantity. If the soil is already rich in nitrates, the leguminous crop may do no more than maintain the nitrogen equilibrium. This is an important thing to do, however, inasmuch as this nitrogen will be required by subsequent crops in the rotation and the requirement of expensive nitrogenous manures is thereby reduced.

VARIETIES AND EFFICIENCY OF ROOT-NODULE BACTERIA.

It is now pretty well agreed that the nodule bacteria on most legumes belong to the same species. However, there are well-defined strains or varieties especially adapted to certain genera and species of legumes which adapt themselves with more or less difficulty to other genera and species. The immediate efficiency of the bacteria will, therefore, depend upon the natural or artificial inoculation of the particular legume with the best strain of bacteria adapted to it. In soils, therefore, where it is desired to cultivate a particular legume, and where that legume or a closely related species has not been successfully cultivated and well supplied with nodules, it is desirable that the proper bacteria be supplied. Experiments and practical tests made by this Department show that there is great variation

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[a] See Bul. 71, Bureau of Plant Industry.

in the nitrogen-fixing power of these bacteria, dependent in part upon the conditions under which they have been growing. If they are in a soil which provides them with an abundant supply of combined nitrogen, they ultimately lose, to a large extent, the power of fixing atmospheric nitrogen. Under such conditions they are of little or no benefit to the crop. It is an easy matter to select strains of high nitrogen-fixing power as indicated by the effect of the bacteria on the crop when growing in comparatively nitrogen-free soils. The cultivation of these selected strains on nitrogen-free media for a few generations greatly increases their nitrogen-fixing power, and therefore their value for inoculation purposes. Exactly the same principles apply to these bacteria as apply to other plants. There are some strains of beets that will make 15 to 20 per cent of sugar. These are worth cultivating for their sugar; but the ordinary strains from which these have been developed by selection contained only 5 or 6 per cent of sugar. A man who wants to make a success of growing sugar beets plants seeds of high sugar-producing strains. The importance of using selected seed for all crops has been so amply demonstrated that no argument in favor of the practice is needed. It is the very foundation of progress in plant culture. Soil bacteria are no exceptions to the rule, and pure-bred bacteria for specific work are as clearly an economic necessity as pure-bred cattle or pure-bred sugar beets.

DISTRIBUTION OF INOCULATED SOIL.

We are often told that these bacteria are widely distributed and are present in most soils. This is true as applied to the older cultivated areas, where various legumes have been cultivated, but it does not follow that soils containing a few or even a considerable number of these bacteria would not be benefited by inoculation with suitable kinds of bacteria. The varieties present may not be adapted to the legume which it is desired to plant, and may have little or no beneficial effect on it, or if the proper strain is present in small numbers it may, and usually does, take several years to bring the bacterial content of the soil up to an efficient basis. This, of course, is too slow a process. It would be just as reasonable to depend on getting a crop of clover or bluegrass in this way. It can be done in some places, but it is at least a makeshift method, and does not appeal to a practical up-to-date farmer.

In newer regions, where legumes have not been cultivated, very few soils have enough of these bacteria in them to be of any practical value, and inoculation is essential. This may be accomplished either by the use of soil from a field where the crop is making a vigorous growth, with the roots well supplied with nodules, indicating that the soil contains the right bacteria, or by the use of pure cultures

from selected plants. The soil method, of course, introduces not only the nodule-forming species, but numerous other forms, such as those previously discussed in this paper, and these may often be as much needed as the tubercle forms. Where they as well as the nodule forms are needed, soil transfer is usually the most satisfactory method of inoculation. This is likely to be the case in "sour" soils. It is, however, expensive and cumbersome, especially where the soil has to be transported for some distance.

Another and much more serious drawback to this method is the danger of introducing into a farm injurious and disease-producing bacteria and fungi, as well as troublesome weeds. It is not safe to use soils from areas in which such pests occur. Anyone who has seen the great injury wrought by root nematodes, the wilt diseases of melons, cowpeas, tobacco, cotton, tomatoes, potatoes, flax, the black-rot of cabbage and cauliflower, the various stem and root diseases of clover and alfalfa, and diseases of other crops almost too numerous to mention, and widely distributed, will investigate carefully before importing soil that may contain the spores of these organisms.

PURE-CULTURE INOCULATION.

For the reasons above mentioned, pure-culture inoculation must eventually mainly replace the soil-transfer methods for all kinds of soil inoculation, but this has not yet been put on a practical basis for any except the nodule bacteria. The improved cultural and selection methods introduced by this Department in the practical handling of these forms have brought within reach of every farmer who may need them pure cultures of the most virile, vigorous, and best types of root-nodule bacteria for each particular leguminous crop. It requires care and skill, however, to make and keep these cultures in good condition. For lack of this, many who have tried to make these cultures have failed. The pure-culture method has come to stay, however. It will be improved by experience and continue to increase in usefulness in the hands of careful and progressive workers. It is suggested, before using cultures from any source, that farmers secure from this Department and read carefully Farmers' Bulletin 240. The Department of Agriculture is distributing the bacteria during the present season (1906) in nitrogen-free liquid cultures hermetically sealed. Excellent results can also be obtained in distributing the cultures in dry form. They must be dried quickly, however, from solutions containing very small amounts of soluble salts, and kept *dry* until ready for use; otherwise they are likely to mold and spoil. This Department has used this method very successfully for several years. It is also used successfully by Ferguson, of the Virginia Experiment Station.[a]

[a] See Bul. 159, Virginia Agr. Exp. Sta.

THE FIXATION OF NITROGEN FROM THE ATMOSPHERE BY ELECTRICAL METHODS.

While much can be accomplished through the agency of soil bacteria in conserving and increasing the supply of combined nitrogen, there will always be a demand, in intensive culture especially, for an immediately available supply of nitrates or other forms of fixed nitrogen. The great Chilean deposits, which furnished more than one and a half million tons in 1905, will, at the present rate of use, according to careful estimates, be exhausted in less than fifty years. It has long been known, however, that atmospheric nitrogen can be oxidized under the influence of electricity, producing nitric oxid fumes, which are then combined with water, to form nitric acid, or with quicklime, forming calcium nitrate. Other bases may also be used. Various attempts have been made from time to time to develop a process by which nitrogen can be combined commercially. The most promising results have thus far been secured with Franck's process of making calcium cyanamid and with the Birkland and Eyde process of producing nitrates. The former process consists in combining nitrogen with the carbides of alkalis, producing cyanids, or, in the case of calcium, producing calcium cyanamid ($CaCN_2$), containing 35 per cent of nitrogen—more than twice the amount present in Chile saltpeter. The calcium cyanamid, when properly used, has proved to be an excellent nitrogenous fertilizer for many crops, and quite equal to ammonia compounds, into which it can be readily converted. The ammonia thus produced can be further oxidized by conducting it over highly heated metallic oxids, thus producing nitric acid.

The Birkland and Eyde process, however, appears to be the most promising as a means of producing nitrates. A special electric furnace is used, in which an alternating electric arc between 3,000 and 4,000 volts is produced in connection with a large electro magnet, which forces it to take the form of a roaring disk of flame. Air is forced through this furnace at the rate of about 3,000 cubic feet per minute, the nitrogen being oxidized in the furnace to nitric oxid. These fumes are then collected, and after further oxidation are absorbed in water towers, forming nitric acid, or by powdered quicklime, forming calcium nitrate. Of course, the nitric acid can be combined with almost any desirable base, such as soda or potash. With cheap water power nitrates can be produced by this process to compete in cost with nitrate of soda.[a]

These direct processes of securing nitrogen will certainly be rapidly improved, and what has been accomplished already in this direction should remove the last vestige of doubt that we shall be able to secure at a reasonable cost all of the immediately available nitrogen we may need, in addition to the great supply that may be secured through bacterial action.

[a] See "Nature," vol. 73, p. 355; also, Exp. Sta. Record, Vol. XVII, pp. 746–750. For a full, illustrated account see Engineering News, vol. 57, No. 6, pp. 150, 151.

OBJECT-LESSON ROADS.

By Logan Waller Page,
Director of the Office of Public Roads.

NECESSITY FOR INSTRUCTION IN ROAD BUILDING.

Improvement of the public roads of the United States is a work of so great magnitude and involves the solution of so many problems of economic importance that it demands attention from every unit of government, from the township to the National Government. At the present time the township, the county, and the State are providing means for the construction and maintenance of roads to the extent of approximately $70,000,000 annually, according to information compiled by this Office. It is unfortunately true, however, that the expenditure of the greater portion of this large sum is intrusted to men who have practically no knowledge of road building and who are acting under systems of road administration and management that are obsolete and totally inadequate.

Until very recent years highway engineering has received slight attention in the engineering schools of the country, and, consequently, the supply of properly equipped men for this branch of engineering has not been equal to the demand. With approximately 2,300,000 miles of rural highways in the United States and an approximate annual expenditure of $70,000,000, the absolute necessity of placing road construction and administration on a correct basis may therefore be seen.

ESTABLISHMENT OF THE OFFICE OF ROAD INQUIRY.

Congress, in 1893, realizing that much work of an investigative and educational character, which could be done best by the National Government, was necessary before any effectual progress could be made in the improvement of public roads, established the Office of Road Inquiry for the purpose of investigating systems of road management and disseminating information on the subject of road building. An appropriation of $10,000 was made to carry out the provisions of this act. Slight changes have been made from time to time in the language of the appropriation bills, and the amounts have

been increased until the Office of Public Roads[a] is now intrusted with the investigation of systems of road management, the giving of expert advice on road building, investigation of road materials and their chemical and physical properties, and the dissemination of information upon these subjects. The appropriation for the fiscal year 1907 is $70,000.

The act of Congress provides for two distinct fields of educational and investigative work, one bearing upon the economic questions involved, and the other upon the practical and technical features of road construction and maintenance. The work along economic lines is defined by the requirement that systems of road management be investigated. The practical side of the work is indicated by the provisions of the bill which require that expert advice be given and that road materials be investigated. The giving of expert advice has to deal primarily with the construction and maintenance of all classes of roads, while the investigation of road materials includes field and laboratory tests, as well as an investigation into the quantity, quality, and location of road-making materials in all parts of the country.

OBJECT-LESSON ROADS.

The Office of Public Roads, in endeavoring to carry out the provisions of the act of Congress, has adopted a method of instruction known as the object-lesson road method. Its purpose is to instruct local road builders in the principles of road construction, to demonstrate the advantage of a properly built road, and to ascertain the best local material available for road building.

The Office maintains a corps of highway engineers, expert road foremen, and machinery operators for field duty; and also chemists, geologists, and engineers to investigate by laboratory and other tests the properties and relative values of road materials. When a county or community desires to improve its roads, application is made to the Office on a form which is furnished upon request. This application provides that the local authorities shall guarantee right of way, all materials, common labor, teams, and fuel, the Office furnishing engineering advice, surveys, estimates, expert supervision, and road machinery. The following questions accompany each application form sent out:

Can you supply this Office with plan and profile of road?

What is the nature of the soil along the proposed road?

What is the general grade of road—level, rolling, or hilly?

Does the road cross any waterways? If so, what are their widths, what kinds of culverts or bridges are now in use, and what is the condition of each?

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[a] This is the present title of the Office.

Have you a crusher or any road-building machinery that you will furnish? If so, what?

What is the cost of labor per day?

What amount of money is available to be expended on this work?

What months are preferable for carrying on this work? Why?

What is the earliest date this work can start?

What kinds of road-building materials are locally available, and how far are they situated from the road? Samples of such materials should be selected and shipped to this Office, that tests may be made before construction is started. Blank forms and instructions are supplied for this purpose.

The system now in effect provides for an inspection report by the engineer first sent out to examine the road proposed for improvement, this report covering the following essential points:

Miles of road inspected and location.

Length of section to be improved.

Relative amount of travel over road compared with other roads in vicinity.

Local authorities having jurisdiction over road to be improved.

Individuals or organizations especially interested in the work.

Amount from public treasury.

Amount from private subscription.

Total amount of money ready for the work.

Nearest shipping point. Name of railroad.

Best time of year for doing work (state earliest and latest months), and why.

Nature of materials and distance from road.

Present grades; drainage; nature of soil.

Cost of labor and teams per day.

Engineers or surveyors in vicinity competent to make plans and profiles of road.

If, after consideration of the inspection report, it is decided to undertake the work of construction, surveys are made and estimates prepared, after which the expert foreman, machinery operator, and necessary road machinery are provided. Daily reports are required from the beginning of the work. These daily reports contain exact and detailed information, as shown by the copy of the blank form on the following page. It will be seen from the form that the unit cost may be computed from the data contained in these reports, thereby affording a basis for estimating cost of additional mileage.

When an object-lesson road is completed a final report and summary of the work done is prepared by the engineer in charge of the construction, which shows all details of the work, such as the length, width, thickness, and kind of surfacing material; method of construction and time consumed; kind and size of machinery used for excavation, crushing, loading, distributing, and rolling stone; kind, size, and length of all side, cross, and under drains and culverts; together with the total cost of the road to the community and to this Office, and the unit cost (that is, the cost per cubic yard, square yard, or ton) for excavation, quarrying, crushing, hauling, spreading, sprinkling, and rolling.

DAILY REPORT OF WORK ON OBJECT-LESSON ROAD AT ———.

Date: ———. Weather: ———. Length of working day: —— hours.
Signature: ———.

Force employed.

	Total in hours or days.	Pay per hour or day.	Total.
Foremen			
Subforemen on			
Excavation:			
Men			
Teams			
Shaping:			
Men			
Teams			
Quarry:			
Men			
Teams			
Crusher:			
Men			
Engine and engineer			
Hauling surfacing material:			
To crusher			
To road			
Loading surfacing material at			
Spreading surfacing material			
Steam or horse roller			
Sprinkler			
.... masonry			
Shoulder drains			
.... drains			
Water boy			
Watchman			
....			
Total			

Work done.

Earth excavation	...cu. yds.	Sta. ...to Sta. ...
Subgrade shaped	...sq. yds.	Sta. ...to Sta. ...
First course placed	...sq. yds.	Sta. ...to Sta. ...
Second course placed	...sq. yds.	Sta. ...to Sta. ...
Surface course placed	...sq. yds.	Sta. ...to Sta. ...
Road surface completed	...sq. yds.	Sta. ...to Sta. ...
Material crushed		

Materials used, paid for by unit measure.

	Quantity.	Price.	Total.
Surfacing material			
Fuel for crusher			
Fuel for roller			
Oil, waste, repairs			
Drain pipe, sizes			
Cement			
Total			

Remarks: ——.

In every case samples of all available road materials are secured by the inspecting engineer and sent to the laboratory of the Office for analysis and comparative tests. Such tests are made free of charge to citizens of the United States, and proper instructions for shipping the rock samples are furnished upon request, with details as follows:

(1) All samples should be selected to represent as nearly as possible an average of the material.

(2) A sample of rock for laboratory tests must consist of stones which will pass through a 3-inch but not through a 1½-inch ring—excepting one piece, which should measure approximately 4 by 6 inches on one face, and be about 3 inches thick. The whole sample should weigh not less than 30 pounds. It is desired that samples of rock be shipped in burlap bags.

(3) A sample of gravel must weigh not less than 25 pounds, and should not contain stones over 1 inch in diameter. Such samples must be shipped in boxes, sufficiently tight to prevent the finer material from sifting out.

(4) A sample of paving brick must contain 36 whole bricks, or 24 blocks, which must be securely packed in a box for shipment.

(5) A blank form and addressed tag envelope will be supplied by the Office for each sample. The blank form must be filled and placed in the tag envelope, which must be used as the address for the sample. It is essential that the blank forms be filled with the utmost care, as they are filed as records of the samples.

(6) The Office desires to keep a record of the actual wear on roads built of the materials tested. If the material which this sample represents has been or is about to be used on roads, this Office desires to be informed of the addresses of those in charge of the construction and maintenance of such roads.

The engineer, when making his preliminary investigation, gives due consideration to transportation facilities, railroad rates, and nearest material within shipping distance, in case local materials are unsuitable, inaccessible, or available only at prohibitive cost.

The cooperation in object-lesson road work is entirely free, and the local authorities are not required to pay any portion of the salary or expenses of the Government engineers or experts, or for freight or repair of machinery owned by the Government.

The construction crew consists of one expert foreman and one expert roller and machinery operator. Heavy machinery requiring the direction of an expert operator is unnecessary, except in the construction of macadam roads, and it frequently is the case that only an expert foreman is assigned to the work. Engineering assistance is given from time to time as the case requires, the work being under the general direction of the chief engineer or the assistant engineer, one of whom is present at some stage in the construction of each road.

The extent of the machinery equipment is governed by the requirements in each case, the outfit for a macadam road usually consisting of wheel and drag scrapers, plows, road machine, crushing plant, distributing and dumping wagons, sprinkler, and roller. (See Pl. IV, figs. 1 and 2.) A modern crushing plant consists of crusher, elevator, revolving screens, and bins for at least three sizes of crushed stone. The capacity of the average portable crusher is from 60 to 100 cubic yards per day. A gravel road usually requires the same machinery, except the crushing plant, while sand-clay roads may be easily constructed with a plow, road machine, and horse roller, though if excavation is required, wheel and drag scrapers may be necessary.

The horse rollers generally used by this Office are from 3 to 4 tons in weight. Ten-ton steam rollers have been used on most of the object-lesson roads, although 7½-ton rollers were used in a few cases.

The assistance given by the Government in object-lesson road building is not designed to extend beyond the educational stage, and it is, therefore, usually confined to such length of time as is necessary to instruct properly the local road foreman, who is expected to continue the construction begun by the Government engineers. No definite

length of road is guaranteed to be built, but it may be said that it rarely exceeds a mile, and is usually less than that distance.

It may be well to state that owing to the immense number of applications for object-lesson roads it is never possible to comply with all requests, and the practice is therefore followed of apportioning assistance to those sections of the country which have previously received the smallest percentage, or which stand in greatest need of this kind of instruction. Requests receive due consideration in order of priority, so far as the location of the construction outfits will permit.

PURPOSES OF OBJECT-LESSON ROAD WORK.

Briefly stated, the purposes of object-lesson roads are, first, to introduce among local road builders correct methods of construction and maintenance; second, to demonstrate the advantages of a properly built road in order to stimulate public sentiment for road improvement and arouse a spirit of progress; third, to afford a basis for estimating cost of additional road construction, which may be subsequently carried on by the county or community; fourth, to demonstrate the availability and relative value of local materials as far as practicable; or, where no local material exists, to determine whether materials can be shipped in by rail so as to make the construction of hard roads feasible at moderate cost.

The most important effect of the object-lesson road is the consequent improvement in methods of construction. The widespread ignorance of the elementary principles of road construction has already been mentioned. It is fortunately true, however, that these principles are not intricate nor difficult to learn, and a small amount of instruction properly directed in each community will go far toward promoting a general improvement of the public roads. This instruction can not be given theoretically with entire success, for actual experience is essential to the acquirement of a working knowledge of the subject. Practical instruction is easily understood and the knowledge is retained; furthermore, it is an unanswerable reply to incorrect theories often firmly fixed in the minds of the ultraconservative element of a community.

Another advantage which frequently accrues to localities through this medium is the substitution of less costly methods of construction for those already in use. In 1905 the construction of a short section of sand-clay road, near Troy, Ala., established the wisdom of providing a system of sand-clay roads supplemented by macadam only on heavily traveled thoroughfares. At the time of the construction of the sand-clay road the county was almost on the point of issuing bonds for a large amount to construct macadam roads exclusively. The result has been the saving of a large sum of money, with no material curtailment of transportation facilities.

Nearly all innovations, whether labor-saving inventions, scientific discoveries, or economic achievements, have met at their inception

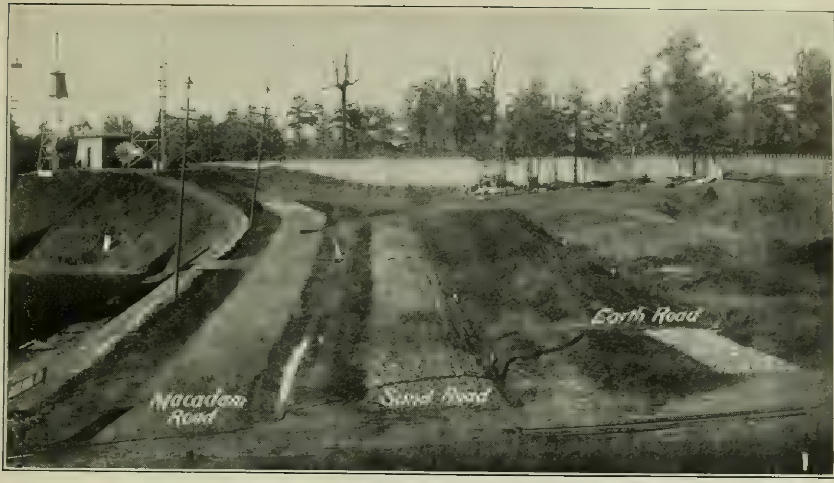

FIG. 1.—FIRST OBJECT-LESSON ROADS BUILT BY THE OFFICE OF PUBLIC ROADS, ATLANTA, GA., 1895.

FIG. 2.—TARRING ROAD AT JACKSON, TENN.—LATEST ADVANCE IN ROAD SURFACING.

FIG. 1.—BEFORE IMPROVEMENT.

FIG. 2.—SUBGRADE READY FOR MACADAMIZING.

FIG. 3.—FINISHED MACADAM ROAD.

THE EVOLUTION OF A COUNTRY ROAD, UNIONTOWN, ALA.

with determined and bitter opposition from the majority. It is the energetic, progressive minority to whom we must look for material as well as intellectual progress, and so it is in many communities with regard to road improvement, where the narrow conservatism of the majority may stand as an obstacle to the inauguration of any well-defined and comprehensive scheme looking toward the betterment of the roads. The cooperation of the local authorities in the construction of an object-lesson road is frequently accepted as a compromise measure and serves as a sort of test case to determine whether a progressive or a passive policy shall prevail in the community. The road thus serves as the entering wedge in the establishment of a system of improved highways and the consequent development and advancement of the material prosperity of the country.

While the cost of roads varies widely, owing to the variation of the factors entering into road construction, such as the amount of excavation, cost of material, depth and width of material, and wages of laborers, it is possible to approximate the cost of additional road building in a section of country where an object-lesson road has been built by applying the unit-cost data of the completed road to the known conditions. For instance, while it would not be safe to say that because an object-lesson road was built at a cost of $4,000 per mile the average cost for additional construction should be $4,000, it would be practicable to arrive at the total approximate cost by comparing each unit of cost and allowing for differences known to exist.

In some cases satisfactory roads are being constructed at a great cost not justified by existing conditions. The object-lesson road often serves as a check upon this kind of extravagance or dishonesty.

In some localities hard roads are being built of material brought in by rail, whereas a local material could be used to advantage at lower cost. In other cases no effort is made to build macadam roads because of the lack of a suitable material in the immediate locality. Macadam roads have been built at moderate cost of material hauled by rail distances exceeding 100 miles. In still other cases inferior materials are used when good material may be had at the same cost. The object-lesson road, in conjunction with the testing laboratory, is designed to meet these conditions.

Until the fiscal year 1905, the Office of Public Roads was unable to perfect a system whereby complete cost data and record of construction could be obtained and placed in the hands of local road officials. Under the present system the file for each object-lesson road contains application, inspection report, profile and cross section, estimate, machinery report, daily reports of work, final report, laboratory tests, and photographs showing various stages of progress. Duplicates of these records are available for the use of the authorities having jurisdiction over the road improved.

EXTENT OF OBJECT-LESSON ROAD CONSTRUCTION.

The first object-lesson roads were constructed on the grounds of the Cotton States and International Exposition, at Atlanta, Ga., in 1895. Three roads were constructed, of macadam, sand, and earth, respectively, as shown in Plate V, figure 1. The macadam road was 300 feet in length, in 50-foot stretches, each of different grade, the first being level, and the others having 2, 4, 6, 8, and 10 per cent grade, respectively. The sand and earth roads were each 200 feet in length, divided into 50-foot stretches, and conforming in grades to the macadam road. The surface of the macadam road was composed of Trenton limestone brought from quarries near Chattanooga, Tenn., the depth of material being 6 inches and the width 12 feet.

Cooperation with experiment stations in carrying on object-lesson road work in conformance with the provision in the act of Congress requiring the Office of Road Inquiry to assist agricultural colleges and experiment stations was first undertaken at Geneva, N. Y., during the fiscal year 1895–96. It was found at the beginning of the work that to restrict it to cooperation with experiment stations would limit its usefulness too greatly, and since 1896 the construction of object-lesson roads has been carried on throughout the entire country in direct cooperation with local officials. During the fiscal year 1896–97 object-lesson roads were constructed at New Brunswick and Florence, N. J.; Ilion, N. Y.; Warren, Pa.; and Kingston, R. I. During the following year the scope of the work was broadened materially. Fourteen roads were built that year, located in Maryland, Ohio, Minnesota, Wisconsin, Iowa, Nebraska, and the District of Columbia.

It will be noticed that at first this object-lesson work was confined to the Eastern States, but during the year 1897–98 most of the work was done in the Middle West.

During the fiscal year 1899–1900 there was a marked curtailment in the object-lesson road work, only 5 roads having been constructed in 1899 and 8 in 1900. Since 1900 this branch of the work has had more attention, 14 roads having been constructed in 1901, 15 in 1902, 9 in 1903, 3 in 1904, 19 in 1905, and 17 in 1906.

Owing to larger appropriation and increased facilities, it is expected that a greater number of object-lesson roads will be completed during this year (1906–7) than in any previous year since the Office was established. Already roads have been completed at Seattle, Wash.; Salem and Pendleton, Oreg.; Bozeman, Mont.; Benton, La.; Dyersburg, Tenn.; Occoquan, Va.; Chevy Chase, Md., and Washington, D. C. Other roads are under construction at Oswego, Kans.; New Orleans, La.; Paintsville, Ky.; Lenoir City, Tenn., and Williamsburg and Norfolk, Va.

In all, 113 object-lesson roads have been constructed since the beginning of the work, distributed in 32 States, as follows: 12 in Ohio; 8 in North Carolina; 7 in Florida, South Carolina, and Virginia, respectively; 6 in Alabama; 5 each in Missouri and Tennessee; 4 each in

Georgia, Kentucky, Louisiana, Maryland, and Pennsylvania; 3 in Arkansas, Michigan, New York, and Washington, respectively; 2 in the District of Columbia, Illinois, Kansas, Minnesota, Mississippi, Nebraska, New Jersey, North Dakota, and Texas, respectively; and 1 each in Iowa, Oregon, Rhode Island, Vermont, West Virginia, and Wisconsin.

Local materials were used in the construction of these roads wherever it was possible. Limestone was the principal material, though various grades of granite and trap rock were used in many places. The number of roads built of each particular variety of material was as follows: Limestone, 30; granite, 21; gravel, 12; trap and basalt, 9; sand clay, 9; chert, 9; shells, 3; novaculite, 4; steel track, 4; gneiss, 3; earth, 2; brick, 2; slag, 1; burnt clay, 1; hornblende-schist, 1; marl, 1; and oil, 1.

The following table gives in brief form all of the essential details relating to the dimensions and cost of the object-lesson roads built in 1904–5:

Data in relation to object-lesson roads constructed in 1904–5.

Place.	Materials used.		Dimensions of road.			Cost.		Cost of labor per day.
	Kind.	Source and transportation.	Length.	Width.	Depth.	Per square yard.	Rate per mile.	
			Ft.	*Ft.*	*In.*			
Fernandina, Fla	Shells	Local	1,199	24	6	$0.348	$4,899.84	$1.00
Pensacola, Fla	Granite and trap	Ballast from Germany.	506	32	6	.429	8,053.76	1.25
Jacksonville, Fla	Marl	By rail 250 miles	5,280	15	6	.592	5,211.03	1.25
Neosho Mo	Novaculite	Local	2,640	12	7	.434	a 3,055.36	1.00
Beaumont, Tex	Clam shells	By boat 28 miles	3,154	16	7	1.019	b 9,565.01	.....
Tallahassee, Fla	Sand-clay	Local	4,480	16	7½	.055	516.27	1.00
Pensacola, Fla	Sand-clay	Local	1,800	15	8	.140	c 1,232.00	.....
Gainesville, Fla	Flint	By wagon 6 miles.	265	70	8	.278	11,416.53	1.00
Shreveport, La	Gravel	By rail 32 miles	3,306	16	8	.334	3,135.15	1.00
Walla Walla, Wash	Trap	By rail 13 miles	2,048	18	8	.415	4,382.40	1.50
Bellingham, Wash	Granite	By rail 30 miles	2,050	15	8	.785	6,908.00	2.00
De Kalb, Ill	Limestone	By rail 100 miles	4,510	12	8	.985	6,934.40	1.75
Gainesville, Fla	Sand-clay	Local	5,280	14	9	.107	881.25	1.00
Springfield, Mo	Novaculite	By wagon 2½ miles	1,310	16	9	.335	3,144.53	1.00
Arkansas City, Kans.	Limestone	Local	3,615	14	10	.396	3,252.48	1.50
Chagrin Falls, Ohio	Sandstone and granite.	Local	2,400	10	10	.800	4,693.33	1.50
Columbus, Ohio	Bricks and granite.	Local	835	18	10	.976	d 10,306.56	1.50
Lebanon, Mo	Novaculite	Local	2,950	9	11	.335	e 1,768.80	1.00
Clarksdale, Miss	Burnt clay	On road	300	12	....	.210	f 1,478.40	1.25

[a] Includes $408.25 for culverts.
[b] City and county prisoners used for labor. Cost was for material only, at $2.15 per cubic yard.
[c] Convict labor used.
[d] Bricks from burned buildings were crushed and rolled for foundation; bowlders from fields were crushed and used for surfacing.
[e] Novaculite from fields was used.
[f] This was an experimental road.

In view of the fact that the width of the roads built during 1904–5 varied from 9 to 70 feet, it will be interesting to compare the estimated average cost of each kind of road constructed, per square yard, and also per mile, for a roadway 12 feet wide. This information is shown in the following table:

Comparison of cost of roads 12 feet wide built of different materials.

Kind of material.	Number of roads built.	Cost of road. Per square yard.	Cost of road. Rate per mile.
Granite	4	$0.747	[illegible]
Limestone	2	[illegible]	[illegible]
Shells	2	[illegible]	[illegible]
Marl	1	[illegible]	[illegible]
Trap rock	1	[illegible]	[illegible]
Novaculite	3	[illegible]	[illegible]
Gravel	1	[illegible]	[illegible]
Flint rock	1	.278	[illegible]
Burnt clay	1	[illegible]	[illegible]
Sand-clay	[illegible]	[illegible]	[illegible]
Average		.442	[illegible]

It will be seen that the average cost of the 10 different kinds of roads in 1904–5 was 44 cents per square yard, and that the average rate per mile for a 12-foot roadway was $3,105.99.

The maximum cost of macadam roads constructed during the fiscal year 1905–6 was $1.42 per square yard, the average 67 cents, and the minimum 24 cents. (See table on p. 147.) The clam and oyster shell roads cost 39 cents per square yard, and the gravel and chert roads, 11 cents. The average cost of the sand-clay roads was 4½ cents per square yard. It will be noticed that the maximum and the average cost of macadam roads during 1905–6 were somewhat higher than in 1904–5. This is due to the fact that the cost of labor and teams had advanced during the year 1905–6 and that more unfavorable conditions were encountered during that year. The average depth of material in the roads built during the year 1905–6 was about 7 inches. The average width of macadam was 18 feet, and the average rate per mile for the macadam roads constructed was $6,642.80.

If all the roads constructed in 1905–6 had been only 12 feet wide, then the rate per mile for the macadam roads, at the average rate of 67 cents per square yard, would have been $4,716.80; the cost of the oyster-shell road, at 39 cents per square yard, would have been $2,745.60; the cost of gravel and chert road at 11 cents per square yard, would have been about $774.40 per mile and the cost of sand-clay roads, at the rate of 4½ cents per square yard, would have been $217 per mile.

Data in relation to object-lesson roads constructed in 1905-6.

Place.	Materials used. Kind.	Materials used. Miles from source.	Dimensions of road. Length.	Dimensions of road. Width.	Dimensions of road. Depth.	Dimensions of road. Area surfaced.
			Feet.	*Feet.*	*Inches.*	*Sq. yds.*
Coshocton, Ohio	Gravel, sand, and limestone	1.28	4,335	9-15	10	5,891
Auburn, Nebr	Limestone	.80	3,900	[a] 15	10	6,623
Columbia, Mo	Limestone	Local.	5,253	16	6	9,339
Macon, Mo	Limestone	Local.	3,700	14	8	5,776
Pullman, Wash	Basalt	Local.	1,338	14	6	2,081
Texarkana, Ark	Chert Gravel	2.00 .70	3,334	12	7	4,445
San Antonio, Tex	Limestone	2.25	1,469	27.4	6	4,478
Lafayette, La	Clam and oyster shells	.75	600	14	6	982
Snow Hill, Ala	Limestone	.50	4,446	12	6	5,928
Uniontown, Ala	Limestone Chert and slag	5.00 175.00	5,500	12-14	6	7,684
Abbeville, S. C	Gravel and chert	2.50	1,979	18-24	6	4,473
Union, S. C	Granite	2.00	1,602	32-40	8	6,893
Kenansville, S. C	Sand-clay	.20	5,900	20	6	13,111
Kinston, N. C	Sand-clay	Local.	600	16	6	1,066.6
Newbern, N. C	Sand-clay	Local.	800	12	3	1,066.6
Washington, N. C	Sand-clay	Local.	2,700	14	6	4,200
Mount Weather, Va	Hornblende-schist	.20	2,047	15-18	6	4,783

Place.	Cost. Total cost.	Cost. Per square yard.	Cost. Rate per mile.	Cost of labor and teams per day. Men.	Cost of labor and teams per day. Teams.
Coshocton, Ohio	$2,820.29	$0.48	$2,534.00 to 4,224.15	$1.60	$3.50
Auburn, Nebr	9,416.07	1.42	[b] 12,496.00	1.50	3.00
Columbia, Mo	5,004.28	.54	5,120.44	1.50	3.00
Macon, Mo	3,229.16	.561	4,607.67	1.50	3.00
Pullman, Wash	2,438.50	1.17	9,600.00	2.50	4.50
Texarkana, Ark	2,968.99	.668	4,702.02	1.50	3.50
San Antonio, Tex	4,398.57	.981	[c] 15,711.70	1.50	3.00
Lafayette, La	383.50	.39	3,200.00	1.25	3.00
Snow Hill, Ala	2,465.53	.41	2,886.40	.75	2.25
Uniontown, Ala	2,677.06	.35	2,460.00 to 2,874.00	1.00	3.50
Abbeville, S. C	496.00	.11	1,419.73	[d] .75	[e] 2.50
Union, S. C	1,671.42	.242	5,494.37	.75	[f] 2.50
Kenansville, S. C	440.35	.033	387.18	.80	2.25
Kinston, N. C	31.45	.03	276.92	[g] 1.00	2.50
Newbern, N. C	28.86	.027	190.09	....	....
Washington, N. C	375.50	.09	739.13	1.00	2.50
Mount Weather, Va	[h] 2,629.81	.55	5,913.60	1.50	3.50

[a] Including curb 10 inches wide and 12 inches deep, built to protect road from floods.
[b] Cost more than usual, on account of curb, extra depth of material, and other extras. Road entirely submerged by floods for seven days during construction.
[c] A great deal of rain and very hot weather prevailed, which made it expensive to prepare the subgrade of "black gumbo" soil. This work was located on a city street, but the cost of curbs, together with the cost of lowering water and gas mains and making sewer connections, has been omitted, so that the cost may be compared with the cost of country roads.
[d] Convict labor used; price paid for subsistence was $0.30 per day.
[e] Traction engine used for hauling surfacing material; cost per day, $5.50.
[f] Traction engine used for hauling stone; cost per day, $5.
[g] Twenty-three convicts were employed on this work, at $0.75 per day.
[h] Cost of curbs, catch-basins, and brick-paved gutters has been omitted, in order that the cost may be compared with that of country roads.

The foregoing data relating to cost of object-lesson roads do not include the expense incurred by this Office, which is approximately 10 per cent of the total cost. It must not be supposed, however, that the same kinds of roads as those which have been built under the direction of this Office can always be constructed in any locality at the same rate, but it is safe to say that where the same conditions prevail as to the cost of labor, materials, etc., the rate should be practically the same, or less if the work is done on a large scale.

RESULTS.

It is interesting to observe that progress in road building has usually followed the construction of object-lesson roads.

This has been demonstrated beyond doubt in a number of cases, among which may be mentioned the following:

KNOXVILLE, TENN.—In 1899 an object-lesson road was constructed at this place which occasioned much interest, not only in Knox County, but in adjoining counties. The officials of Bradley County, after a careful inspection of the road at Knoxville, started a movement to issue bonds to the amount of $90,000 for the purpose of carrying on similar work in Bradley County. After much opposition the plan was put into effect. The consequent improvement in the roads was of such general benefit that additional bonds were issued, bringing the total issue to $186,000. These bonds met so great a demand that $210,000 was realized from their sale. Lands that were worth from $8 to $10 per acre before road improvement now find ready sale at from $15 to $30 per acre.

MADISON COUNTY, TENN.—This county has expended $150,000 and is preparing to expend an equal additional amount on road building, following the construction of an object-lesson road in 1901. Madison County has now over 50 miles of high-class macadam roads.

PENSACOLA, FLA.—The following is a report on the object-lesson road built in 1904:

> Since its construction the work of building temporary roads has proceeded with good results, and now the city in the near future will issue $150,000 worth of bonds for street improvements, and this sum, together with the sum to be paid by property holders under our law of apportionment, will amount to $450,000, to be expended for this purpose.

GAINESVILLE, FLA.—The following is a report on the object-lesson road built in 1904:

> We immediately invested in machinery, the duplicate of that which you used, and have constructed as nearly as possible like yours 2,613 feet of 50-foot streets, and are following sewer construction on other streets as rapidly as the sewers are put down.
>
> I feel confident that your object lesson here has been of immense benefit to the community. We had an abundance of raw material without knowledge of how to use it.
>
> Directly traceable to your work here is considerable similar construction in the city of Jacksonville, Fla., as well as Lake City, Fla. Both cities sent representatives here to examine your work, and are proceeding on the same line with the same material.

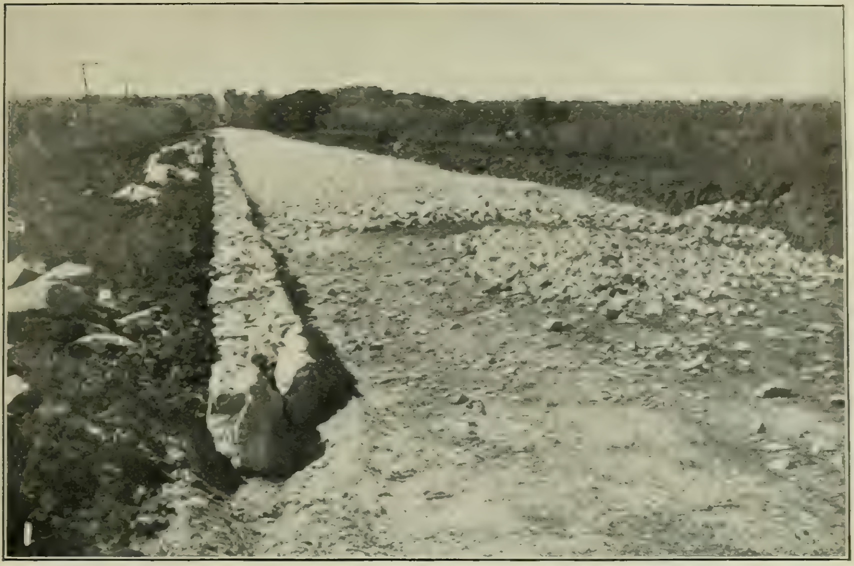

FIG. 1.—METHOD OF CONSTRUCTION, SHOWING CURB TO PREVENT WASHING.

FIG. 2.—ROAD UNDER WATER.

FIG. 3.—COMPLETED ROAD.

MACADAM ROAD AT AUBURN, NEBR., BUILT THROUGH RIVER BOTTOM.

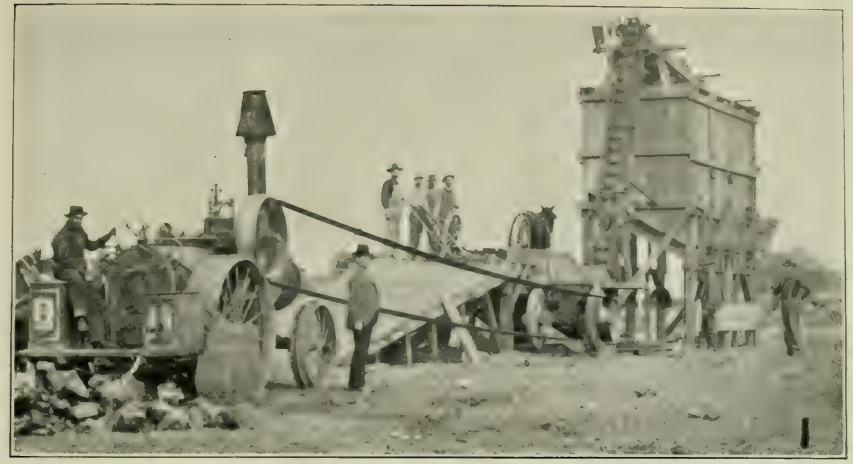

FIG. 1.—CRUSHING PLANT, WALLA WALLA, WASH.

FIG. 2.—PREPARING SET GRADE FOR MACADAM ROAD WITH TRACTION ENGINE AND ROAD MACHINE, ARKANSAS CITY, KANS.

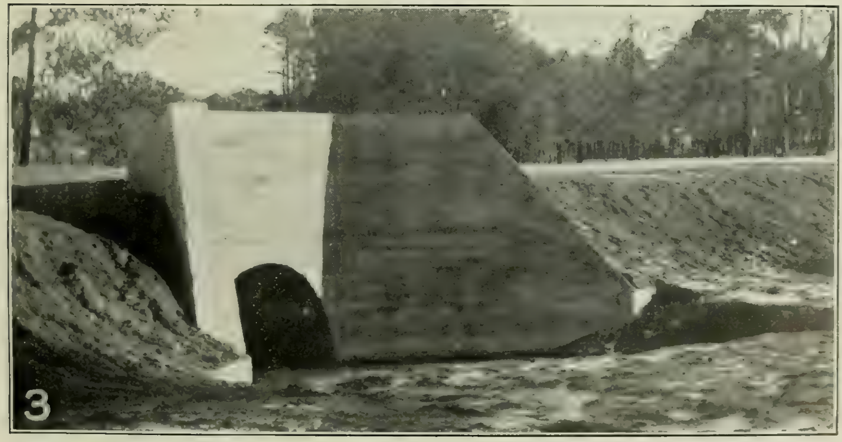

FIG. 3.—CONCRETE BRIDGE, TEXARKANA, ARK.

UNIONTOWN, ALA.—An official of this place reports as follows upon the object-lesson road completed in 1906. Plate VI shows the various stages in the construction of this macadam road.

As a result of the work done here by your Department, the city is now expending $25,000 on the streets.

The whole county is alive with good-roads ideas. The county commissioners will take the matter in hand as to the advisability of making road districts and issuing bonds to improve the roads. All of this comes directly from the object-lesson road built by your Office 1 mile north from city limits.

AUBURN, NEBR.—The following is quoted from a letter concerning the road built in 1906:

There has been an additional mile of road improved as a result of the object-lesson work done at this place, and the Auburn Commercial Club, working in conjunction with the board of county commissioners, expect to go right on with the good work until every public highway leading out of this city has been put in first-class condition.

The splendid effect following the object-lesson road work at this place is so extensive that adjoining counties are sending representatives here to inspect the work and to familiarize themselves with the construction of the road.

It is generally conceded that we now have the finest and most durable section of good roads in the State of Nebraska.

Plate VII illustrates the peculiar conditions met in the construction of the object-lesson road at this place.

IMPROVEMENT OF RURAL MAIL ROUTES.

In order to promote the efficiency of the rural-delivery service and at the same time render effective aid in the improvement of roads throughout the United States, the following plan of cooperation has been arranged between the Post-Office Department, through the office of the Fourth Assistant Postmaster-General, and the Department of Agriculture, through the Office of Public Roads. This plan of cooperation was approved by the Secretary of Agriculture July 3, 1906, and the Postmaster-General July 10, 1906.

Whenever a road upon which a rural route has been or is about to be established is reported by the carrier or inspector to be impassable or in bad repair, the Fourth Assistant Postmaster-General will advise the Director of the Office of Public Roads of the fact and request that he have an engineer inspector detailed to examine the road and give such advice and instruction to the local officials as may be required.

Upon receipt of such information from the Fourth Assistant Postmaster-General, the Director of this Office will communicate with the local officials and supply them with a circular of instructions and a blank form for making application for the detail of such engineer inspector.

It is not the purpose of this Office actually to construct the road or to make any contribution either in money, materials, or labor. In

most cases a road is impassable on account of defects which can be remedied by the use of proper methods. The engineer inspector who examines the road will note carefully all such defects and advise as to what steps can be taken to place the road in proper condition without great expense. If practicable, and if so desired, he may in some cases assume temporary direction of the work for the purpose of instruction.

There will be no expense to the community on account of the detail of such engineer, as his salary and expenses are paid by the Federal Government.

LECTURES ON OBJECT-LESSON METHODS.

The present plan of confining the object-lesson road work to practical instruction will probably be improved in the near future and theoretical instruction by means of lectures will be given in conjunction with instruction by the object-lesson method. A lecture may of itself be entirely inadequate to impart a working knowledge of road construction; and on the other hand it is probable that instruction by the object-lesson method alone will fail to convey a sufficient knowledge of the most difficult points in connection with road building. The theoretical portion of the instruction will probably consist of one or more lectures during the continuance of the work, in which subjects of primary importance will be discussed, such as grading, drainage, selection and preparation of materials, maintenance of roads, operation and repair of machinery, organization, methods of administration, and computation of cost data. These lectures, while intended particularly for road overseers, road foremen, and all officials having connection with road building, are open to the general public and occasion will be given for a general discussion of ways, means, methods, and practice, in addition to the subjects of the lecture. The organization and practice governing teachers' and farmers' institutes will to some extent be applied to these road institutes. It is expected that the authorities having jurisdiction over the road under construction will lend their cooperation in securing the presence of the persons to whom this instruction should be given. In some cases the county court, county commissioners, or county supervisors have authority to direct the various road overseers to participate in the construction of the object-lesson road and in the road institute held in connection with the work; in other cases they can only urge the presence of the overseers. It will of course be necessary that arrangements be made to correspond with local conditions in each case.

By this means it is hoped that the influence of each road institute and object-lesson road will extend far beyond the immediate neighborhood and result in a more widely extended improvement in the public roads than would be possible by following the present plan.

INTRODUCTION OF ELEMENTARY AGRICULTURE INTO SCHOOLS.

By A. C. True,
Director of the Office of Experiment Stations.

The teaching of improved methods of agriculture to the masses of our agricultural youth has recently been advocated by the President of the United States, the Secretary of Agriculture, a former United States Commissioner of Labor who is now the president of a Massachusetts college, the president of one of our greatest railroads, the president of the University of Virginia, the superintendent of schools of New York City, acting as president of the National Educational Association, and by such bodies as the National Educational Association, the National Grange, and the National Irrigation Congress. This may fairly be taken as a sure indication that the discussion of this subject has become very widespread, and that public opinion is becoming crystallized in favor of using the schools for the dissemination of agricultural knowledge. After a long period of comparative neglect of agricultural interests by the leaders of thought and action in this country, a great awakening to the tremendous issues which are involved in the permanent prosperity of our agriculture and in the maintenance of a high level of intelligence among our agricultural people has come, and happily the minds of our most influential men are turning more and more to the public schools as the fittest and best centers from which to spread a knowledge of the principles of agriculture and in which to inculcate a love of country life and an appreciation of the dignity of agricultural pursuits. Sentiments favorable to agriculture are no longer expressed by our public men simply as a compliment to our farmers. It is rather a new and serious sense of the real importance of the farmer to the commonwealth, and a fear of the perils into which the crowding of our population in great cities and the neglect to maintain the fertility of our soil are sure to bring us, that are leading thoughtful men of all classes to pay earnest attention to the educational needs of our rural population. This means a great step in advance on this subject. It is now possible to secure a fair hearing of the claims of agriculture to a place in our public schools and a thorough testing of plans for the teaching of this subject in a wide and effective way. It becomes important, therefore, to look more closely at the methods which are being pursued to acquaint our

farmers, educators, and legislators with the needs of the rural schools in different parts of our country and to make definite suggestions for their improvement.

Under the authority of Congress and the Secretary of Agriculture the Office of Experiment Stations has been collating information from various sources regarding the progress of this movement, and the present summary is presented to show in brief the results of this investigation.

INTEREST AMONG FARMERS' ORGANIZATIONS.

Our investigation shows that in the farmers' organizations throughout the country, which as a rule comprise our more intelligent and progressive farmers, the introduction of agricultural instruction into the schools is being actively discussed and warmly approved. Local organizations are passing this question up to the State organizations, and these in turn are sending it on to the National organizations. Committees on legislation are being appointed, and there are many evidences of an earnest and persistent effort to secure definite results.

Not content to wait for the formulation of definite courses of instruction in agriculture for the rural schools and the training of teachers in this subject, there is in many places an effort to do something tangible to arouse the interest of farmers' boys in the study of agriculture. Through the agency of farmers' organizations cooperating with the State agricultural colleges and State and county departments of education, boys' agricultural clubs have been organized, largely in connection with the schools, in Georgia, Illinois, Indiana, Iowa, Kansas, Nebraska, Ohio, Texas, and probably other States. The members of these clubs have regular institute meetings and lecture courses, go on excursions to educational institutions and large farms, conduct variety tests with corn, cotton, sugar beets, and other crops, and exhibit their products at school, county, and State fairs.

The agricultural press is devoting a larger space than ever before to the discussion of educational topics, and wherever an attempt is made to establish the teaching of agriculture in the schools it is widely and fully advertised. Entire numbers of some papers are given up to the presentation of various phases of agricultural education.

ATTITUDE OF SCHOOL OFFICERS AND TEACHERS.

A remarkable change has taken place in the attitude of school officers and teachers regarding nature study and elementary agriculture as school subjects. A few years ago it was unusual to find any subject relating to agriculture in public schools in the programmes of teachers' meetings. Now scarcely an educational meeting of importance is held anywhere in the United States without at least one paper

on some phase of this subject, and in many cases whole sessions are devoted to the discussion of various topics relating to it, from nature study and school gardening to the more formal courses in agriculture. A few examples will serve to show how widespread is this interest.

At the sixty-seventh annual convention of the American Institute of Instruction at New Haven, Conn., in July, 1906, which is largely attended by school officers and teachers from different parts of New England, the teaching of elementary agriculture was largely discussed in the department of rural education, formal papers on this subject being presented by the superintendent of education of Vermont and the professor of agriculture of the Massachusetts Agricultural College.

New England has also been aroused to a serious and thorough discussion of this matter by the report of a commission on industrial and technical education presented to the legislature of Massachusetts in April, 1906. The chairman of this commission was Hon. Carroll D. Wright, for many years United States Commissioner of Labor and now president of Clark University at Worcester, Mass. This commission was appointed by the governor of Massachusetts in accordance with an act of the legislature, and spent nearly a year in a study of the relation of children to our industries and the condition of industrial education at home and abroad. The commission found that "there is a widespread interest in the general subject of industrial education, or special training for vocations," but that our people generally, and even those who are most interested in the subject, have no definite ideas as to its proper scope or method. "Compared with the opportunities afforded in Europe for acquiring knowledge and skill in productive industry, the work now being done in Massachusetts is strikingly and painfully inadequate," and while in this country "the general public has been strangely blind to the narrowness of the public school education," in Europe there is "the universal recognition of the necessity of special education for every form of industrial life." Among their conclusions were the following:

The State needs a wider diffusion of industrial intelligence as a foundation for the highest technical success, and this can only be acquired in connection with the general system of education into which it should enter as an integral part from the beginning. The latest philosophy of education reenforces the demands of productive industry by showing that that which fits a child best for his place in the world as a producer tends to his own highest development physically, intellectually, and morally.

There seem to be two lines in which industrial education may be developed—(1) through the existing public school system, and (2) through independent industrial schools. In regard to the former the commission recommends that cities and towns so modify the work in the elementary schools as to include for boys and girls instruction and practice in the elements of productive industry, including agriculture and the mechanic and domestic arts, and that this instruction be of such a character as to secure from it the highest cultural as well as the highest industrial value; and that the work in the high schools be modified so that the instruction in mathematics, the sciences, and drawing shall show the application and use of these subjects in industrial

life, with special reference to local industries, so that the students may see that these subjects are not designed primarily and solely for academic purposes, but that they may be utilized for the purposes of practical life—that is, algebra and geometry should be so taught in the public schools as to show their relations to construction; botany to horticulture and agriculture; chemistry to agriculture, manufactures, and domestic sciences, and drawing to every form of industry.

The commission would also recommend that all towns and cities provide, by new elective industrial courses in high schools, instruction in the principles of agriculture and the domestic and mechanic arts.

This commission has been continued, and Prof. Paul Hanus, professor of the history and art of teaching in Harvard University, has been appointed chairman. Professor Hanus is thoroughly alive to the need of industrial education, believing that "the education demanded by democratic society in modern times must be a preparation for active life," and that "the only real preparation for life's duties, opportunities, and privileges is participation in them, so far as they can be rendered intelligible, interesting, and accessible to children and youth of school age." This being so, he favors "liberal provision for elementary training in agriculture, industrial and commercial pursuits, in addition to general manual training, at the upper end of the grammar school and also at the upper end of the high school."

In New York, at the annual meeting of the State Association of School Commissioners and Superintendents, held at Cornell University, in October, 1906, the best means of adapting rural schools to their environment was discussed, and it was generally agreed that agriculture should be taught as a part of the general scheme of pedagogy, of which it should be the basic factor.

In Indiana the county superintendents in twelve counties have organized clubs for the study of crops, and the Association of County Superintendents has asked Purdue University to organize a training school for teachers in agriculture and nature study.

The State Teachers' Association of Michigan at its meeting in 1905 adopted resolutions favoring the teaching of agriculture in the public schools.

In Missouri the State superintendent made the following statement in his report for 1904:

Fifteen years ago I urged at county teachers' associations and granges that the elements of agriculture be taught in public schools. Since then sentiment has grown until there is a great demand for it. For five years the law has recognized it by making it one of a group of subjects from which applicants must select to be examined for first-grade certificate or State certificate. Four years ago State normal schools established departments of agriculture and nature study. There are now many teachers in the State prepared to teach elementary agriculture.

In 1905 the Missouri State Teachers' Association asked that agriculture be made a requirement for any grade of teachers' certificate.

In California, at a joint meeting of the State Teachers' Association and the State Farmers' Institute, held at the University of California

in December, 1905, and attended by some 7,000 persons, the subject of agricultural education was discussed from various points of view, and as a result of this meeting a committee was organized to promote the interests of such education in the public schools of the State.

At a conference for education in the South, held at Lexington, Ky., in May, 1906, and attended by leading educators from a number of States, much attention was given to the claims of agriculture to a place in the school curriculum.

At the meeting of the Virginia State Teachers' Association and affiliated organizations in November, 1906, the teaching of agriculture in the public schools was widely and thoroughly discussed, and President Alderman, of the University of Virginia, in the closing address of that great meeting, declared that among the things which should be considered as settled in the campaign for a better school system now being actively carried on in that State was that agriculture in some form should be generally taught in the schools.

At the annual convention of the National Educational Association, held at Asbury Park, N. J., in July, 1905, elementary agricultural instruction was a prominent subject of discussion, and such instruction was favored in the annual address of the president, Dr. William H. Maxwell, superintendent of schools of New York City, delivered to thousands of teachers at the opening session. The committee on industrial education in schools for rural communities, appointed two years before, brought in an elaborate report, in which it maintained "that the rural schools, which train nearly one-half of the school population of this country, should recognize the fact that the major portion of their pupils will continue to live upon the farm, and should provide specific, definite technical training for them for the activities of farm life. It adduced strong arguments in support of this position and emphasized the educational value as well as the practical utility of courses of study framed with this end in view. The committee favored the consolidation of rural schools in order that teachers specially fitted for this work might be secured and the instruction made more efficient. It also advocated the establishment of high schools to meet the special needs of the rural population for secondary education directly related to agricultural practice."

PROGRESS IN LEGISLATION.

Steady progress is being made in securing legislation favorable to the teaching of agriculture in public schools. The laws of over 30 States now permit or require such instruction. Among the States which require the teaching of agriculture in all elementary schools are Alabama, Georgia, Louisiana, Maine, Maryland, Mississippi, North Carolina, South Carolina, South Dakota, and Wisconsin. Legislation on this subject is commonly accompanied with provisions making

agriculture one of the subjects on which teachers may or must be examined. In Nebraska, for example, candidates for first and second grade county certificates must pass an examination in the elements of agriculture. In Wisconsin, since 1901, teachers have been required to pass an examination in elementary agriculture in order to secure any grade of teachers' certificate. In New Hampshire teachers in secondary schools are required to have training in agriculture. In Virginia teachers securing first-grade certificates must pass an examination on either physical geography, elementary physics, or elementary agriculture. In Alabama, Georgia, Mississippi, Missouri, North Carolina, and South Dakota all teachers must pass examination on this subject. In New York the new syllabus for elementary schools contains nature study and agriculture, and teachers in training classes are required to cover all subjects in the syllabus. In Ohio the Teachers' Reading Circle requires the study of one text-book on elementary agriculture each year. The laws are also beginning to recognize the fact that definite provision should be made for the training of teachers along agricultural lines. Thus a recent act in Michigan, which enables counties to maintain normal training classes with State aid, requires the teaching of agriculture to such classes. In Massachusetts the legislature appropriated $5,000 for normal work at the State Agricultural College as one result of the report of the commission on industrial education above referred to.

It is also being seen that the high schools are very largely the institutions in which the teachers of the rural schools receive their most advanced training, and this fact is now making it easier to secure legislation for high-school instruction in agriculture. Already under State laws there are agricultural high schools in Alabama, California, Minnesota, and Wisconsin. In 1905 the Minnesota legislature passed an act providing for local option in the establishment and maintenance of county schools of agriculture and domestic economy, limiting to $20,000 the amount which any county may appropriate for this purpose in one year. Two or more counties may unite to establish such a school. Each school must have connected with it a tract of land suitable for experiments and demonstrations of not less than 10 acres.

At the session of 1906 the Georgia legislature passed an act establishing 11 agricultural high schools, as branches of the State College of Agriculture. These schools will each receive from the State about $6,000 a year, derived from the inspection fees collected by the State department of agriculture, but each community in which such a school is located must furnish not less than 200 acres of land and the necessary equipment. The people are responding enthusiastically to this requirement, and about $800,000 in land and money has been offered for the equipment of these schools.

In New Hampshire, beginning with 1906, high schools and academies may be approved by the State superintendent of education if they are prepared to teach agriculture.

Recent legislation in Virginia provides for the establishment of public high schools under the authority of the State superintendent of education. Arrangements are being made to open about 150 such schools, and it is intended to make instruction in agriculture a feature of the course in such of these schools as are located in the rural districts.

FORMULATION OF COURSES.

One of the objections often made to the introduction of agriculture into our schools is that the teachers do not know what should be taught under this head. This may have been a valid excuse in the past, but to-day is no longer so. While there is still much difference of opinion as to details, the general scheme of instruction has been pretty well worked out. For example, the Office of Experiment Stations has published an outline plan of a course in nature study and elementary agriculture for rural schools. This was prepared by a committee of the Association of American Agricultural Colleges and Experiment Stations, and therefore represents broadly the views of educators in different parts of the country on this subject. In this publication,[a] which may be obtained on application to this Department, it is suggested that during the first six years of the child's attendance at school he should be led to make observations of the plants and animals on the farm and in the fields and woods, together with simple studies of soils, weather conditions, and other natural objects and phenomena. A more formal study of climate, soils, fertilizers, farm crops, fruits, domestic animals, dairying, farm buildings and machinery, marketing, and farm accounts is outlined for the seventh and eighth school years. The committee has followed this with a series of simple exercises and demonstrations on some of the elementary principles of agriculture. These have recently been published as a circular of the Office of Experiment Stations.

In Missouri a course in agriculture for the public schools was prepared several years ago by the State superintendent of schools. This has since been superseded by a more nearly complete presentation of this subject in a bulletin prepared by the State superintendent and published by the State board of agriculture. This bulletin advocates presenting the subject of agriculture "(1) by experiments at home and in the field, (2) by studying facts as given in texts and bulletins, and (3) by school gardens connected with school grounds." Numerous experiments and observations are suggested throughout the bulletin.

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[a] Office of Experiment Stations Circular 60, The Teaching of Agriculture in the Rural Common Schools.

In Illinois a somewhat detailed course has been prepared by the dean of the College of Agriculture. This course is arranged by months, and gives suggestions for a large number of experiments and observations bearing on all the divisions of agriculture. Considerable reading along agricultural lines is suggested, as well as drawing, composition, and other work intended to correlate agriculture with other school work. This Illinois course has not only been used in that State, but has also been adopted by several other States and published in the reports of their State superintendents of education.

In Minnesota a bulletin prepared by Prof. W. M. Hays, then professor of agriculture of the College of Agriculture and now Assistant Secretary of Agriculture, has been widely used in the schools of that and other States. This bulletin contains a large number of practical and illustrative exercises for use in connection with elementary instruction in agriculture.

In Wisconsin the State superintendent of public instruction, in 1906, prepared an outline for instruction in the elements of agriculture for the use of teachers in common schools. In this outline it is recommended that agriculture be taught in the last half of the eighth year, and that nature study be given in all grades through general exercises and in connection with language exercises, geography, reading, and history. The outline is divided into three parts, (1) agriculture, including the soil, water and the soil, tilling the soil, soil enrichment, the plant, the leguminous plants, plant enemies, rotation of crops, selection of seed, the farm garden, weeds, and home and school gardens; (2) farm animals, including care and feeding, type forms, and farm economics, and (3) farm poultry.

Outlines of courses, sample lessons, and other helps for teachers have also been published by the State departments of education in Georgia, Indiana, Maine, Michigan, Missouri, Nebraska, North Carolina, New Hampshire, New York, and probably in other States.

The New York State department of education has published a syllabus of a course in agriculture for high schools, and this will be followed by a detailed series of lessons and laboratory and field exercises.

PREPARATION OF TEXT-BOOKS AND MANUALS.

The demand for text-books, manuals, and reference books on agriculture adapted to school use is steadily growing. The agricultural experts connected with our agricultural colleges and experiment stations are thus encouraged to prepare such books, and publishers are now active in seeking for books of this character. The number of bulletins useful to teachers and students which are issued by the United States Department of Agriculture and the State experiment stations has greatly increased in recent years, and the demand for these from educational institutions is now large. Among elementary text-books

which are already used more or less extensively in schools are Burkett, Stevens and Hill's Agriculture for Beginners; Goff and Mayne's First Principles of Agriculture; Bailey's Principles of Agriculture; Goodrich's First Book of Farming; Brooks's Agriculture; Jackson and Daugherty's Agriculture through the Laboratory and School Garden; Shepperd and McDowell's Elements of Agriculture (prepared especially for North Dakota schools), and Hatch and Haselwood's Elementary Agriculture with Practical Arithmetic. The last mentioned is an interesting attempt to correlate instruction in agriculture with that in arithmetic by connecting with the several lessons in agriculture a number of practical arithmetical problems directly relating to the farm. For the high-school library and the teachers' use we have such advanced manuals as Hunt's Cereals in America; Smith's Profitable Stock Feeding; Henry's Feeds and Feeding; Jordan's Feeding of Animals: King's Soil, Irrigation and Drainage, and Physics of Agriculture; Decker's Dairying; Snyder's Chemistry of Plant and Animal Life; Mead's Irrigation Institutions; Taylor's Agricultural Economics, and others. For general reference books we have the new International Encyclopedia; Bailey's Encyclopedia of Horticulture; Wilcox and Smith's Encyclopedia for Farmers; Bailey's Garden Craft and Rural Science Series; the Yearbooks of the United States Department of Agriculture, and others of similar character. The bulletins and books which the schools can easily secure contain many descriptions and illustrations of simple and inexpensive apparatus and other facilities which may be purchased or made by the teacher. There is no excuse for keeping agriculture out of the schools to-day because of a lack of suitable books or other aids to such instruction. Suggestions for the adaptation of country schoolhouses to this new work are now being made. At Cornell University a model schoolhouse is being erected, which, in addition to the usual recitation room, will have a large laboratory for nature study and elementary agriculture.

PROVISION FOR TRAINING TEACHERS.

Realizing that a vital point in the effective teaching of agriculture in our public schools is the training of teachers in this subject, the friends of this movement are now making active efforts to establish agricultural courses for teachers in our colleges and normal schools. The agricultural colleges in a number of States have given instruction to considerable numbers of teachers at summer schools. They are now beginning to establish regular normal courses, provision for such work having recently been made at the colleges in Illinois, Mississippi, Massachusetts, Michigan, Missouri, and New York. The colleges in Ohio, Iowa, Illinois, New York, Mississippi, and Rhode Island also have so-called extension departments which are seeking to come into close

touch with teachers as well as with country boys and girls, and thus promote the wider diffusion of agricultural education. These colleges are also using their influence to turn students in their regular courses to the career of teaching. The agricultural high schools, whether attached to the agricultural colleges or independent of them, are also training teachers. Some of the normal schools in Alabama, Georgia, Idaho, Illinois, Iowa, California, Louisiana, Maine, Massachusetts, Michigan, Missouri, Montana, Nebraska, North Dakota, Oklahoma, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin are giving regular instruction in nature study and elementary agriculture.

ORGANIZATION OF AGRICULTURAL SCHOOLS.

Meanwhile the establishment of courses in agriculture in secondary and primary schools is going on in different parts of the country. The agricultural high schools organized in connection with the agricultural colleges in Minnesota, Nebraska, Oklahoma, Rhode Island, and Washington report an increased number of students, and are better equipped than ever before. The National Farm School at Doylestown, Pa., has been recognized by the State legislature, which granted it an appropriation of $12,000, to be used for agricultural instruction. This school now receives more applicants for admission than it can accommodate, and is obliged to keep a waiting list. In Wisconsin the Dunn County School of Agriculture and Domestic Economy at Menominee has graduated three classes—21 boys and girls in 1904, 19 in 1905, and 16 in 1906. The California Polytechnic School, at San Luis Obispo, has become firmly established and has a good equipment and a considerable number of agricultural students. The nine district agricultural schools in Alabama are steadily growing in popularity, and the efficiency of their agricultural work has been much increased. The agricultural course at the Mount Hermon School, in Massachusetts, is being well maintained. In Missouri agriculture is being taught in 200 high schools, in Ohio in 30, and in one or more schools in Alabama, New Hampshire, Pennsylvania, New York, Iowa, Kansas, Nebraska, Louisiana, Indiana, Maine, Idaho, Montana, North Dakota, Oklahoma, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, and Wisconsin.

Agricultural high schools have recently been organized at Crookston, Minn., and Calvert, Md. At the latter a graduate of the Iowa Agricultural College has been elected principal, and a course of study closely following the course recommended by the committee on instruction in agriculture of the Association of American Agricultural Colleges and Experiment Stations[a] has been adopted, and the

[a] Office of Experiment Stations Circular 60.

agricultural work is arousing much interest not only among the pupils but also among the farmers of the county. The principal visits other schools in the vicinity for the purpose of getting their teachers and pupils interested in agricultural subjects. The school is strictly rural, and although it has been running only since the 1st of November, 1906, there is an enrollment of 47, the school building is crowded, and already there is talk of a new building next year. Georgia is organizing eleven such schools. The agricultural courses in schools for negroes at Hampton, Va., and Tuskegee, Ala., are maintained very efficiently, and efforts are being made to strengthen the agricultural courses of secondary grade in a number of the land-grant colleges for negroes in other Southern States.

In Ohio it is reported that elementary agriculture is taught in approximately 500 township schools; in Missouri in 3,000 schools; in North Dakota in 300 schools; and this subject is regularly taught in a considerable number of schools in Alabama, Georgia, Illinois, Indiana, Indian Territory, Iowa, Louisiana, Maine, Nebraska, New Hampshire, New York, Pennsylvania, South Carolina, South Dakota, Virginia, Wisconsin, and Washington.

NUMBER OF PUPILS STUDYING AGRICULTURE.

Reliable statistics of the number of pupils studying agriculture in our public schools are not available, but from the reports recently received at the Office of Experiment Stations it is certain that they are numbered by thousands. From the report of the State superintendent of education of Missouri for 1905 we have gathered the following interesting statistics: The total number of schools doing high-school work in that State is 555, with 1,428 teachers and 28,354 students. The total number of students in agriculture is 1,180. In the sciences, which are more or less related to agriculture, the numbers are as follows: Botany, 2,742; zoology, 1,905; chemistry, 1,492; physics, 3,386; physical geography, 4,215; physiology, 3,411. Latin is taken by 14,117 students, but Greek by only 200. In manual training there are 2,582 students, in bookkeeping 1,534, and in stenography 436. As some indication of the number of farmers' children in these high schools it may be stated that there are 4,000 nonresident pupils. From these high schools come very largely the teachers required by the elementary country schools, and 3,000 new teachers are needed for these schools in Missouri each year. These statistics show several things: (1) That a good beginning has been made in teaching agriculture in the Missouri high schools; (2) that there is so much elementary science taught in these schools that there should be little difficulty in laying a proper foundation for effective agricultural instruction; (3) that there are so many

farmers' children in these schools that with proper courses of instruction the high schools of Missouri may easily become powerful agencies for sending back to the farms young people thoroughly alive to the advantages of country life and the requirements of a progressive agriculture; (4) that it is vital to the advancement of the best interests of the elementary rural schools that the atmosphere and instruction of schools should be favorable to agriculture, for to these high schools the country school must largely look for teachers.

HOW FARMERS MAY HELP THE SCHOOLS.

Having now reviewed the progress which has been made in recent years in opening the way for the teaching of agriculture in our public schools, it may be well to give brief attention to some of the ways in which the farmers themselves may further promote the improvement of the rural schools in this and other respects. Our agricultural communities have never been so prosperous as to-day. And there is every reason to believe that with intelligent management of the land and sound judgment in the marketing of the products this prosperity may be permanently maintained. The farmers now have the means to improve not only their lands and buildings, but also their general social conditions. The experience of the past century has shown that a thorough and effective school system in which the curriculum recognizes the industrial, intellectual, and social needs of the community is a most influential factor in promoting material wealth, as well as a broad and satisfactory life. Our farmers will be wise, therefore, if they use a portion of their increased means to strengthen and improve the rural schools. Some have feared that agricultural prosperity would lead to a neglect of education in our rural communities. But the indications are that this is not to be so. Our agricultural colleges and schools report both an increase in the number of students and an improvement in their quality. It appears that with the improvement of agricultural conditions there is a renewed interest in farming as a business, and farm boys of strong mental caliber and active ambition are seeking in larger numbers to prepare themselves in the best way for a life on the farm.

There is also widespread recognition of the fact that our present agricultural prosperity rests on a different basis from that of previous periods in our history. There have been times when multitudes of our farmers were prosperous because they had occupied large areas of virgin soil freely granted them by the Government or purchased at a very low price. To-day our agricultural prosperity has come partly from increased demand for farm products at home and abroad and partly from the more skillful use of the land and the growing of improved crops and animals. And the improvement of agricultural

methods and products has been very largely the result of the work of the United States Department of Agriculture and the State experiment stations. Technical and scientific knowledge is, as never before, a requisite of the most successful farming. The schools can be made efficient aids to the acquirement of that knowledge which our farm youth must have in order to perpetuate and extend the prosperity which their fathers now enjoy. Therefore our intelligent farmers are seeking to improve the rural schools, and will do so more actively as they come more generally to understand the importance of such action.

Better-trained teachers, improved school houses and grounds, more apparatus and books, free transportation of pupils to consolidated schools, high schools made available to all country children, and the teaching of agriculture and home ecomonics will cost something, and if they are to be had they must be paid for. But unless all past experience is a false guide, this improved school system will be one of the most profitable investments ever made by a civilized community. And if our farmers are alert to their interests they will push these improvements along rapidly, and they will not permit the entire expense to come out of the taxable farm property. The villages and cities, whose prosperity rests on the farms, and the accumulated wealth of the State should contribute to the education of the rural people. This is already recognized in a number of our States as a wise and just principle. The nation has also recognized it by appropriating large sums for the higher agricultural education.

It can not be too strongly urged that the movement for the improvement of the rural schools, and in particular for the teaching of topics directly relating to agriculture and farm home life, should receive the active support of the masses of our farmers. And this support should be felt in our legislatures, boards of education, and local school management. This will require study of the present condition of our rural schools and careful consideration of their needs. As regards agricultural instruction there should be an understanding of what the elementary and secondary schools may properly teach and the relation of such studies to those ordinarily pursued in our schools. For example, our farmers should come to understand that it is not the ordinary practice of agriculture which can or should be taught in the public schools. It is rather the observation of the things in the natural world which the farmer has to deal with, the use of natural laws for the benefit of agriculture, the reasons why certain farm practices are beneficial and others injurious to the land that the school may teach. For example, in a dairy region the composition of milk, the causes of the souring of milk, and the ways of preventing this may be taught in school; in a potato-growing region, the nature and cause of potato blight, the reason why it is necessary to spray the vines before the disease appears; where the

soils are deficient in nitrogen, the advantage of green manuring with leguminous plants and the reasons therefor; in an arid region, the use of the soil mulch and why it prevents the escape of soil moisture. And, above all, the farmer should see to it that the rural school-teacher is a friend of agriculture and loses no good opportunity to show his or her pupils the advantages and opportunities of country life.

The farmers can also do a great deal to promote the teaching of agriculture in the rural schools by encouraging the teachers to take up this subject and to prepare themselves to give instruction in it. The farmers are very largely the managers of rural schools and their children are the teachers in them. Merely by taking an active interest in the local schools, inviting the teachers and scholars to visit the farm, especially when there are unusually good crops and fine animals to be seen there, or sending specimens of products or injurious birds or insects to the school, the intelligent farmer may help to create a sentiment in favor of agricultural instruction there. Teachers, like other workers, will inevitably respond to an active demand for new things. As soon as it becomes generally understood that the farmers are bound to have agriculture taught in the schools, candidates for teachers' positions will get ready to teach it. With many of our educational leaders fully believing that subjects directly related to the life work of the pupils should be taught and a host of the intelligent farmers insisting that our future agricultural prosperity will largely depend on such teaching in the schools, a way will surely be found to bring this great reform to a successful issue. Meanwhile let us have great patience with even the most imperfect attempts on the part of our schools to work along this line. The whole matter of elementary and secondary instruction in agriculture is in an experimental stage. Many trials of courses, methods of teaching, books, apparatus, and other facilities must be made before plans fully adapted to the conditions of different agricultural regions can be matured. Intelligent and kindly criticism should be invited and utilized by all who are engaged in this work. In this way alone can the best progress be made.

What is now being done, with all its imperfections, is tremendously important. Principles of action are being determined. Every successful example of the effective teaching of agriculture, whether in a little country school or in the agricultural high school, is helping to indicate along what line the future growth of this movement must proceed. There is therefore much cause for congratulation that in so many different States and under such a variety of conditions honest and substantial efforts are being made to solve the problems of our rural schools and to test the usefulness of agricultural instruction as a means of improving country life and perpetuating agricultural prosperity.

CAGE-BIRD TRAFFIC OF THE UNITED STATES.

By Henry Oldys,
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INTRODUCTION.

Three hundred thousand cage-birds, largely canaries, are annually imported into the United States. Some of these are destined for zoological parks and a few for private aviaries, but the great majority find their way into the hands of those who desire to have a cage-bird or two to brighten the home. This yearly influx of captive birds may seem large, considering the comparatively small number usually in evidence; but it must be remembered that they are scattered over an area of more than 3,000,000 square miles, and are distributed among a population of more than 80,000,000, which allows but 4 birds a year to every 1,000 persons, or about 400 birds to a city of the size of Columbus, Ohio.

The practice of keeping live birds in confinement is worldwide and extends so far back in history that the time of its origin is unknown. It exists among the natives of tropical as well as temperate countries, was found in vogue on the islands of the Pacific when they were first discovered, and was habitual with the Peruvians under the Incas and the Aztecs under Montezuma. Caged birds were popular in classic Greece and Rome. The Alexandrian parrakeet—a ring-necked parrakeet of India—which is much fancied at the present day, is said to have been first brought to Europe by one of the generals of Alexander the Great. Before this living birds had been kept by the nations of western Asia, and the voices of bulbuls and other attractive singers doubtless added to the charms of the hanging gardens of Babylon, while in China and Japan the art of domesticating wild birds has been practiced for many centuries.

It is not difficult to account for the motive that underlies this widespread habit. The same spirit that leads to the domestication of wild flowers for adornment of the home and the pleasure derived from their beauty or fragrance is responsible for the similar transplanting of wild birds from their natural homes to those of their captors, and the parallel extends to the subsequent production of new varieties.

As a people, Americans have less of this spirit than prevails elsewhere. Despite the multitudes of birds weekly entering the country—a single vessel will occasionally deliver ten or fifteen thousand—our

interest in avicultural pursuits is comparatively slight. In Europe aviaries are numerous and their owners maintain a common interest by means of avicultural organizations and periodicals. Bird shows are held annually or oftener in London, Berlin, and many other European cities. A friendly but keen rivalry prevails among the owners of aviaries as to which shall first succeed in breeding species that have not previously been bred in captivity or in producing new hybrids. The journals and magazines devoted to aviculture serve as a medium of exchange of methods and experiences and keep their readers in touch with each other. In Germany, particularly, the practice of keeping, rearing, and studying cage-birds is very common. In many a dwelling one room is set apart for birds, and these bird rooms are not confined to a particular class, but are found in the homes of people of every rank and condition. As long ago as 1880 some 200 societies of amateurs existed, and several weekly publications and magazines devoted to birds attested the general interest in avicultural pursuits.

The breeding of cage-birds for sale is a regular occupation in several parts of Europe. Germany produces hundreds of thousands of singing canaries in the Harz Mountains, those of St. Andreasburg being unrivaled songsters; in England, Scotland, and Belgium fancy varieties of canaries are regularly bred for the trade; and at the Royal Society's zoological gardens of Antwerp, Belgium, the breeding of many species of foreign cage-birds is systematically conducted.

The United States has few aviaries, and most of these are devoted to pheasants and other large birds. For a few years an avicultural periodical was published, but the support it received was apparently insufficient, and at present there seem to be no periodicals and very few associations strictly devoted to aviculture. Hence in this country there is not that community of interest and information that characterizes the avocation in Europe. America supports a few small shows, mainly exhibitions of canaries; and small exhibitions of cage birds, mostly canaries, are usually held as adjuncts to the annual poultry shows of New York, Boston, Chicago, Toronto, and other cities. The breeding of canaries and cage-birds for the trade in any numbers is practically unknown on this side of the Atlantic.

TRAFFIC IN DOMESTIC BIRDS.

The once extensive trade in native American birds has dwindled to the vanishing point. Formerly mockingbirds, bluebirds, cardinals, tanagers, indigo birds, and nonpareils were caught in large numbers and sold either here or abroad, and more or less trade in other species prevailed. Bluebirds, which are known as blue robins or blue nightingales in England and France, were imported into England some time before 1869, as in that year they were first bred in the London

Zoological Gardens. They are regarded with much favor by amateurs and have been repeatedly bred in private aviaries. Mockingbirds were bred in French aviaries before 1873. While intolerant of cage mates, they are much valued in Europe for their song, which, however, is there considered inferior to that of the nightingale—a judgment partly assisted, perhaps, by patriotic bias and association. Scarlet tanagers and cardinals are ranked very high in Europe, and frequently win prizes in bird shows. Evidence of the esteem as cage-birds in which the latter are held is shown by the fact that they are listed on the price list of a London bird dealer for September, 1906, at more than $5 apiece. Of interest in this connection is the statement of Gemelli Careri, quoted by Nuttall in his Manual of Ornithology published in 1832, that "the Spaniards of Havana in a time of public distress and scarcity bought so many of these birds [cardinals], with which a vessel was partly freighted from Florida, that the sum expended at $10 apiece amounted to no less than $18,000." Indigo birds and nonpareils are valued for their attractive plumage. Of the latter thousands were annually exported to Europe, where they sold for $1.50 to $2 apiece.

In consequence of the continual trapping to supply the increasing demand, several of these birds became rare in localities where once they had been common. Nearly every State had a law protecting nongame birds, but such laws were at that time imperfectly framed and ineffectively enforced. The usual exception authorizing the keeping of birds in cages as domestic pets was unaccompanied by any restriction on trade, which, in consequence, flourished. Imperfect as these laws were, they were rendered still less effective by the absence of public interest in their observance and adequate provision for their enforcement. Gradually, however, the influence of the bird-protective movement began to make itself felt and the laws were improved. One State after another adopted a model law framed by a committee of the American Ornithologists' Union, which instead of simply prohibiting the killing of a few birds specifically named, as had formerly been done, prohibited the killing, capture, or possession of all birds other than game birds and a few injurious species, and interdicted all trade in them. The interest in bird life awakened by the efforts of this organization and the various State Audubon societies caused these laws to be more or less vigorously enforced, and the trade in native birds declined proportionately. Supplies were still obtained, however, from States that had not adopted modern laws, and the export trade to Europe continued brisk. One by one these remaining strongholds were carried by the forces of bird protection until finally, in 1904, Louisiana, the only State left from which birds were procurable, adopted the model law, and now, beyond a few surreptitious and illegal shipments, the domestic and foreign trade in native

American birds has been entirely abolished. Occasionally a small consignment of mockingbirds or cardinals is smuggled to Hamburg or some other European port, but the life of the trade is gone.

TRAFFIC IN FOREIGN BIRDS.

The importation of foreign cage-birds has grown to its present proportion, not only in this country, but in Europe as well, within the last fifty years. Up to the middle of the last century, apart from parrots and some other of the larger species, few birds were imported into Europe, and as late as 1860 only about 60 different kinds of foreign birds were brought in, and these in moderate numbers. But about this time a rapid increase began, and by 1880 the species imported approximated 700 and the individuals from 500,000 to 800,000. The Japanese robin, a favorite cage-bird of to-day, was first brought to the London Zoological Gardens in 1886, and the shell parrakeet of Australia, now one of the best known of exotic birds, and sold at wholesale in London for about $1.37 a pair, was first brought to England by Gould in 1840, and for the next ten years commanded $100 to $125 a pair.

In the United States the growth of importation has undergone a similar development, lagging, however, slightly behind the European growth. In both cases the sudden invasion of the markets by foreign birds was due to the advantages of quick transportation. When supplies from distant lands were brought by sailing vessels but few birds survived the long voyages. But the steamship afforded opportunity for conveying birds with speed and safety, and dealers were quick to avail themselves of the changed conditions. As long ago as 1865 there was a brisk American trade in foreign cage-birds of all kinds, and by 1880 this had so increased that a single dealer in New York City handled 70,000 canaries each season.

NUMBER OF BIRDS IMPORTED.

The decline in the trade in domestic cage-birds has doubtless stimulated the trade in foreign cage-birds, which advanced from 235,433 imported under permit of the Department of Agriculture in the year ending June 30, 1902, to 322,297 in the year ending June 30, 1906, an increase of 37 per cent in four years. At the beginning of this period the model bird-protective law previously mentioned had been adopted by 16 States; at its close it was in force in 35.

Of the birds imported in the year ending June 30, 1906, 274,914 were canaries and 47,383 miscellaneous birds. The canaries were nearly all raised in Germany. Thirty-three per cent of the miscellaneous birds were from the Orient, 30 per cent from Europe, 22 per cent from Australia, 7 per cent from Cuba and Mexico, 6 per cent from

Africa, and 1 per cent from South America. The remaining 1 per cent were of unknown origin. In addition to these, 2,700 canaries, mostly from Germany, and about 6,000 parrots from various tropical countries came in without permit, no permit being issued for these birds when they are unaccompanied by others.

HOW BIRDS ARE SECURED.

A peep behind the scenes is always interesting, and when we see diverse and remote regions of the world pouring their treasures of bird life into our country a desire is awakened to know by what means this is accomplished.

In some cases the method is as old as the history of maritime commerce. From the time when vessels began to make voyages to other countries sailors have brought back trophies of various sorts, including specimens of the fauna of distant lands. Some birds are still thus brought in and are bought by dealers in the various ports of entry.

This method, somewhat systematized, prevails at San Francisco, where the trade, temporarily suspended by the earthquake and fire, is now beginning to revive. Supplies are here obtained from the crews of steamers coming from China and Japan, who make a regular business of transporting cage-birds, usually under an arrangement with the steamship companies by which they are employed whereby freight is paid out of the proceeds of sales. The birds thus imported are considerable in number, but few in species, being mainly Java sparrows, diamond sparrows, Chinese mockingbirds, and other common kinds.

But most of the birds imported are secured by more highly organized methods. Several of the leading importers maintain forces of men to secure the desired birds either in their native haunts or in European ports to which they are brought by the agents of other importers.

Parrots are generally taken while still in the nest. During the nesting season the leading American houses send men to Cuba, Mexico, or South America to obtain stock. Headquarters are established by these agents at some point convenient to the parrot country and natives are employed to secure the young birds, which are forwarded to the United States in periodical shipments. Agents have sometimes been sent from this country to Africa to secure supplies of the favorite African gray parrot, but these are usually obtained in European ports from vessels arriving with supplies for the large European houses.

Small birds, other than canaries, are generally captured with nets. Expert netters continually visit remote regions in the interest of wholesale houses of Hamburg, London, Liverpool, and other large cities of Europe. Similar expeditions are dispatched from New York and Philadelphia to Cuba and Mexico and occasionally to more distant lands—even India; but the principal American houses maintain connections with establishments in Germany, through which their supplies of Old World and South American birds are more commonly procured.

Canaries are obtained by agents who visit breeders in the Harz Mountains, the Tyrol, and other parts of Europe. A few, however, are imported at San Francisco from breeders in China and Japan.

HOW BIRDS ARE SHIPPED.

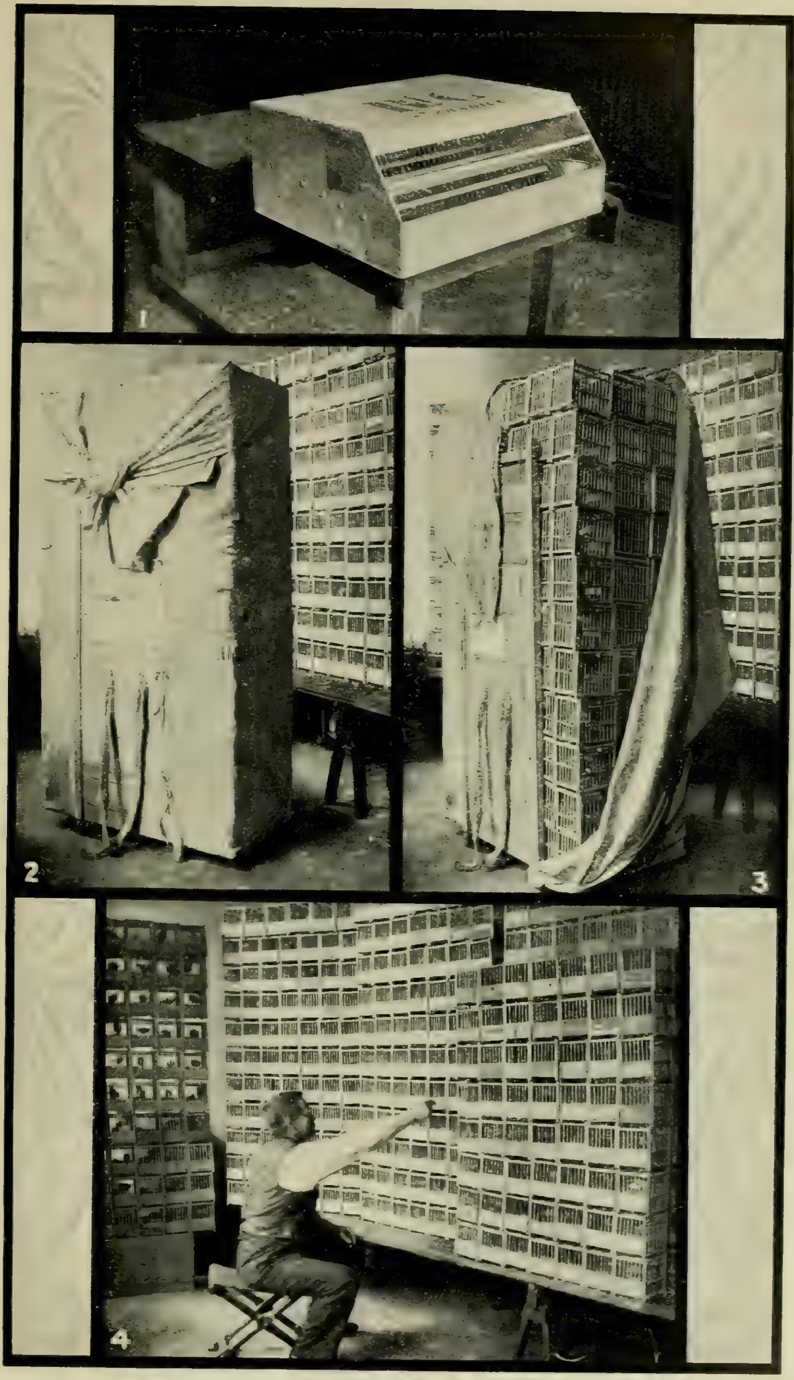
Most of the small birds received from Africa and Australia are shipped in large boxes especially prepared for the purpose (see Pl. VIII, fig. 1). These boxes are of different sizes and accommodate from 1 to 125 or 150 birds, according to size of box or of birds shipped. Shell parrakeets are sent from Australia in especially large boxes, sometimes as many as 500 making the journey in a single box. The birds so shipped are of a peaceable disposition and may be caged together without fear of their injuring one another; but some birds, such as bullfinches, goldfinches, and male canaries, are quarrelsome, and each bird has to be placed in a separate cage.

Canaries are confined in small wicker cages, seven of which are strung on a stick, constituting what is technically known as a row. When shipped across the ocean these rows are crated and a linen or burlap sack specially made for the purpose is placed about each crate (see Pl. VIII, figs. 2 and 3). A crate usually contains 33 rows. To paraphrase the old riddle—every sack has 33 rows, every row has 7 cages, every cage has 1 canary (or sometimes 2 if the occupants are the more peaceable females). Often more than two dozen crates are shipped in one consignment. Each of these must be opened every day of the voyage, every row removed, and food and water placed in the cages. In this daily re-crating the rows are rearranged so that the benefits of outside positions may be more evenly distributed among the birds.

On arrival in port consignments of birds (which pay no duty) are entered at the custom-house under permit from the Department of Agriculture, usually secured in advance by the importer. The larger shipments are generally examined by one of the special inspectors of the Department stationed at the principal ports of entry. Nearly all shipments subject to such inspection enter at New York and Philadelphia. After the inspector has examined a consignment to ascertain that it contains no objectionable species, and has noted, for subsequent report to the Department, the number and kinds of birds it comprises, the importer is free to dispose of it.

It is the aim of the importer to sell his stock as quickly as possible, to diminish his losses by death and so increase his profit. It is estimated that the mortality en route and in the store among some of the more delicate species of birds, such as African finches, may reach 14 per cent.

Zoological parks and aviaries are usually supplied direct by the importers, but the general public is reached by way of the retailer.



METHODS OF SHIPPING AND TESTING CAGE BIRDS.

[1.—Cage for shipping small birds (see p. 170). 2.—Crate of canaries ready for shipment (see p. 170). 3.—Crate of canaries partly open to show rows of cages (see p. 170). 4.—Testing singing of canaries (see p. 173).]

Many small bird stores are scattered over the country, and some of the large department stores have added birds to the great variety of merchandise they handle. Small consignments are shipped to retail dealers by express (at double rates). In the cages or boxes are placed water and food sufficient to last until arrival at destination. Sometimes, when the distances are unusually long, the express messengers supply fresh water and food en route, and large consignments are often accompanied by agents of the importers. Several of the principal importers have branch establishments at various points, such as New Orleans, Chicago, and San Francisco, which fill western orders.

THE RETAIL TRADE IN BIRDS.

While retailers do more or less business during the entire year, three well-defined seasons are established. In February canaries begin to breed, and for the first two or three months of the year the trade in breeding canaries, especially females, is brisk. About the time it subsides the first shipments of young parrots arrive from Cuba and Mexico. These at once take the stage and hold it until the middle of August, when it is no longer possible to secure young birds. Interest then turns chiefly to singing canaries and the many other small cage-birds that are imported. The sale for these grows greater and greater and reaches its maximum by Christmastide, after which it abruptly declines. Many dealers probably make more sales in December than during all the rest of the year. In the Christmas season of 1905 one Philadelphia department store sold 4,000 canaries, besides other cage-birds.

From the character of the demand for cage-birds it is evident that the retail trade is, as a rule, not enough by itself to yield a profitable income. It is usually, therefore, combined with some trade of an allied nature. In retail bird stores one may usually find fowls of various kinds, pheasants, dogs, monkeys, squirrels, white mice, guinea-pigs, goldfish, and even lizards and snakes. The sale of food and cages also constitutes an item, and sometimes the proprietor acts as surgeon and physician to domestic pets.

SPECIES IMPORTED.

During the year ending June 30, 1906, more than 200 species of cage-birds were imported into the United States. These comprised canaries, parrots (under which term we may include parrakeets, cockatoos, macaws, and lories), European birds, Oriental birds, African birds, Australian birds, and a few South American, Mexican, and Cuban birds. It is obviously impossible, in the space of the present article, to consider all these in detail; but a brief account of some of the most important will be of interest.

CANARIES.

So widely known has the sweet-singing canary become that should an inhabitant of one of the civilized countries of the world visit the Canary Islands and hear the wild birds in their native home the strains would, in all probability, bring to the traveler memories of his own home. The clear and varied notes of this favorite singer are familiar to young and old, and many dwellings, from the great mansion to the obscure cottage, are alike brightened by their beauty. The position of the canary among cage-birds is unique—not only because of its widespread popularity, but also from the fact that centuries of domestication have rendered it peculiarly dependent on man. Its cage has become its natural home and to it liberty would probably mean death.

The bird is a native of the Canary Islands, the Azores, and Funchal (Madeira), and is said to have been brought from the Canaries to Spain and kept as a cage-bird by the Spanish nobility shortly before the time of the discovery of America. Other accounts make Italy the first country into which it was introduced and place the time early in the sixteenth century. It is sufficient for present purposes to note that it has been domesticated and prized as a cage-bird for the past four centuries. The wild bird is smaller than the bird now so familiar, and is also differently colored, having less bright yellow and considerable olive and brownish in its coloring. Nor does it sing as sweetly. Nevertheless, it is so attractive that soon after its introduction it became a general favorite, and was bred so assiduously that it is said that by the beginning of the eighteenth century 27 different varieties were produced. It is interesting to note that canaries are now exported from England to the Canary Islands.

The canary is a very good imitator. Mature birds have been known to reproduce very closely the songs of even such birds as chewinks, house wrens, and others, and the faculty has been utilized by breeders to determine to a certain extent the quality or character of the song of a young bird. In Germany young canaries have been associated with nightingales and in England with woodlarks to this end. But the method commonly employed at present is to place the young bird with a canary that possesses a superior song and is kept solely for training purposes. The fine singers used for this purpose are called "campaninis" and command high prices. Singers are measured by the richness and sweetness, not the strength, of their tones. Thus the voice of one of the choice St. Andreasburg "rollers" (which sell at wholesale for $24 to $36 a dozen, according to season, while ordinary canaries range from $15 to $21 a dozen) could easily be drowned by the singing of many an inferior canary. A single bird with a superior voice, especially a campanini, will sometimes command a price for which several dozen ordinary singers can be bought. Ordinary female birds,

on the other hand, which are purchased mainly for breeding purposes, may be had as low as $6 a dozen at wholesale.

As previously stated, singing canaries are bred in the Harz Mountains of Germany. Large numbers are raised by the cottagers of this region and are bought directly from them by buyers for the wholesale establishments of Germany and England and the German branches of American establishments. How much the industry means to the peasants near St. Andreasburg, the Brocken, and other localities in the Harz Mountains may be gathered from the fact that thirty years ago it was estimated that the trade amounted to $300,000 a year.

Some canaries sing much more freely than others, and immediately after the arrival of a consignment at the store of the importer the interesting process of testing the singing qualifications of the different individuals is begun. Cages are piled one deep in a tier containing 40 or 50 rows. In front of this large, somewhat semicircular pile, each cage containing a single occupant, sits the tester, watching and listening (see Pl. VIII, fig. 4). Many notes are to be heard, but it is difficult to determine from which of the many scores of throats they proceed. This is the duty assigned the tester, and when he is certain that any particular bird is singing, he places a chalk mark on the cage containing it. Marked cages are subsequently removed and their occupants are sold as guaranteed singers. Testing canaries is difficult and requires both patience and training, yet on a clear, sunny day, when the birds sing more freely and can be more clearly seen, an expert will sometimes mark 500 cages.

In the breeding of canaries song has not been the only desideratum, but has shared consideration with shape and color. The potency of artificial selection is as well shown in this pursuit as in the rearing of fancy pigeons, and some quite as distorted shapes are produced. Thus Belgium has succeeded in giving to the world a big canary with broad shoulders abnormally raised above the small head. And Scotland has produced a type—the Scotch fancy canary—that is bent like a bow, so that when the bird is at rest on a perch a line drawn from bill to tip of tail would pass well in front of the feet. Other abnormal products of breeders' ingenuity are the Yorkshire canary, very long and very slim, and the Lancashire or Manchester coppy, well proportioned, but a very giant among canaries.

Still other fancy varieties are the Norwich canary, at present a popular favorite, the London fancy canary, the border fancy canary, and the lizard canary, a dark bird with gold or silver spangles and yellow crown. All these are further subdivided by breeders and fanciers. Norwich canaries and Manchester coppies are frequently ornamented with crests. Endowing with a crest a bird that has none naturally is striking evidence of the possibilities of artificial selection.

The diversity is further augmented by color possibilities. All canaries are either "yellow" or "buff." These are technical terms, however, and are somewhat misleading. A yellow (or jonque) canary is one whose plumage is lustrous; a buff (or mealy) one is one whose plumage is dull and has a frosted appearance. Cinnamon canaries with pink eyes, and green and piebald canaries also, are bred, and a few decades ago it was discovered that by feeding young canaries freely on cayenne pepper the yellow could be deepened into a rich orange. The combinations offered by these different characteristics are very numerous, and when to them are added the results of hybridizing with other species—goldfinch, linnet, siskin, and others—as is done for the production of the much-prized "mules," unlimited possibilities seem to open out before the breeder. In breeding for shape and color, singing qualities are neglected, and canaries in which these are so highly developed often have little left of the sweet song that was the chief cause of their original domestication.

In view of the great number of varieties that have been produced and the differences in style and quality of song, and taking into consideration also the patience, care, and skill bestowed by breeders in producing and maintaining at an established standard the various results of their work, it is not surprising to find great differences in the prices of canaries. Ordinary male canaries may be bought for $1.50 to $2 apiece at retail, and from this the prices rise, through Norwich, Yorkshire, lizard, Manchester, and Belgian canaries in order, and reach in the last a wholesale rate of $30 to $50 a pair. Song production has not been led into bizarre channels, and that beauty of song is more highly estimated than odd shape is shown by the fact that one of the finest singers among the "rollers" may command as much as $150.

PARROTS.

So far as known, the first introduction of parrots into Europe occurred in the fourth century B. C., when, it is related, one of the generals of Alexander's army, returning from India, brought with him specimens of the ring-necked parrakeet. These parrakeets, which were called "Alexandrian parrakeets," after the monarch in whose reign they were introduced, are still very popular with bird-fanciers, and are so common in India that sailors continually bring them to Europe and America. They are docile, and while slow in acquiring speech, finally make excellent talkers. Roman writers inform us that they were not eaten in India, but were held sacred because of their ability to reproduce human speech.

African parrots were brought to Rome in the time of Nero from beyond upper Egypt, where they had been discovered by explorers. They were highly prized, both as pets and as table delicacies, by the

Romans, who kept them in cages of tortoise-shell and ivory with silver wires, and often paid more for one than for a slave.

The earliest knowledge we have of the keeping of West African parrots as pets in Europe dates back to 1455, when Senegal parrots were first introduced. American parrots owe their introduction into the Old World to Columbus, who carried a few back with him on his return from his first voyage to America. They were among the objects of interest when he made his formal entry into Seville on March 31, 1493. Five years later the Portuguese circumnavigated the Cape of Good Hope, subjugated a part of India, and reintroduced the Indian parrots into Europe.

The most popular parrots are the little green Australian parrakeets, variously known as shell or grass parrakeets, budgerigars, or love birds. These birds, familiar on the city streets in the capacity of fortune-tellers and performers of tricks, are retailed in this country at $4 or $5 a pair. They are among the easiest of all foreign birds to breed and are raised in large numbers in Europe, from which source come many of the birds brought to the United States. In the year ending June 30, 1906, we imported 5,387 to supply the demand, including a few of a yellow variety produced by the breeders of Belgium and France. Shell parrakeets are easily transported from Australia, owing to their ability to exist for long periods without water, and have frequently been carried to Europe in sailing vessels, making a three or four months' voyage, without being supplied with water.

Cuban parrots have recently risen in favor and several thousand were needed to meet the year's demand. These medium-sized green, red, and blue birds with whitish crowns make fairly good talkers, and sell at wholesale for $24 to $27 a dozen.

Amazons from Mexico and Central and South America, which average $6 apiece at wholesale, are favorites among the larger parrots. They are known as blue-fronted, red-fronted, yellow heads, double-yellow heads, etc., according to the markings of the head. The blue-fronted amazons seem to be preferred in Europe; but the double-yellow heads make the best talkers, and when well trained command prices ranging as high as several hundred dollars apiece.

The African gray parrots are probably unrivaled in ability to reproduce human speech, and have been popular pets in Europe since the Middle Ages. Unfortunately they do not stand transfer very well and the great majority of the few imported die soon after arrival.

The larger parrots have not yet learned to talk when they arrive, and, as a rule, are disposed of at once to retailers. By these they are often taught by means of specially constructed graphophones, which automatically repeat, for hours at a time, selected words, phrases, or songs.

Parrots often attain great age—gray parrots have been known to live ninety years. They display affection and intelligence, and make very interesting, albeit somewhat noisy pets. They should be allowed frequent liberty from the cage for exercise, where it is feasible; and they are much pleased and benefited by simple toys with which to relieve the tedium of confinement—an empty spool, a piece of tape fastened to the wire of the cage, or some similar object.

Macaws, large birds with glaring reds, blues, yellows, and greens in their coloration and with voices to match, are secured in tropical America; a few lories are brought from the Pacific regions; and many cockatoos from Australia and neighboring islands. Of the last the rose cockatoo from the Moluccas seems to be preferred. Nearly 300 were imported during the year. Both macaws and cockatoos are difficult to handle. Their powerful beaks are weapons not to be despised, and are used so freely that specially strong cages and perches are needed to withstand their destructive attacks. Macaws were greatly prized as pets by the Peruvians before the Spanish conquest.

The little yellow-crested cockateels from Australia seem to win less favor here than in England, where they are fairly common in aviaries, while but 30 or 40 seem to be enough to supply our annual needs. They retail here at $8 apiece and in England at about $2.50 a pair, a difference in price that may partly account for the difference in favor.

EUROPEAN BIRDS.

The European birds ordinarily imported are sold at wholesale for $9 a dozen, with two exceptions—siskins, plain-colored birds, which are usually secured for crossing with canaries and which bring only $6 a dozen, and trained or "piping" bullfinches, which command $15 each. The handsome goldfinches are easily first in popular estimation, as is shown by the fact that 5,000 are annually brought in. Of bullfinches, 1,500, mostly untrained, entered during the year. More than a thousand each of siskins and linnets are imported each year and several hundred skylarks and chaffinches. Song thrushes, blackbirds, and black-caps show some degree of popularity; and so doubtless would the robin redbreast—the true robin of our nursery tales and jingles—were it easier to keep alive in confinement. Nearly a hundred nightingales are annually brought across the ocean, but very few ever again utter the song that has become so famous. Their silence is a mute but eloquent protest against their captivity, and serves to remind us that in caging a bird we do not necessarily cage its song.

ORIENTAL BIRDS.

The Orient furnishes several of the most popular cage birds—Java sparrows, of which we imported 6,285 in the year ending June 30, 1906;

Japanese robins, of which 4,539 were brought in; Japanese nuns of various kinds, which aggregated 1,780; and strawberry finches, of which 1,280 were needed to supply the demand.

Java sparrows, also known as paddy or rice birds because of their destructive work in rice fields, are hardy and breed freely in captivity. Their general color is a soft bluish gray, set off by the red bill and conspicuous white marking about the face. A white variety has been produced in the Orient. These retail for $3.50 each, while the grays bring only $1.50 apiece. Pure whites are not very common—in most white birds more or less of the blue-gray appears. Java sparrows were among the earliest foreign birds imported both in Europe and the United States, and those procured for the trade are, like canaries, chiefly cage-bred birds. The Japanese now breed these birds in large numbers. In order to increase production they raise the young by hand, feeding them with a sort of spoon cut from a thin bamboo splint. The old birds, thus relieved of the care of their young, are free to breed again at once.

Japanese robins, usually called Pekin nightingales by English aviculturists (who know our cardinals as Virginia nightingales), were imported to the number of 4,539. They are peculiarly colored—dark and greenish with distinctive yellow and orange on breast, bill, and wings. They are easy to keep, possess a sweet and musical song, and have a song period of ten months, which contrasts favorably with those of most cage-birds, the nightingale, for example, which, when it sings at all, is in song for only two months. They are native in China, Japan, and India, and were first brought to England about 1866 and to the United States ten or fifteen years later. They retail at $4 each.

Nuns are small birds of different species, such as the black-headed, white-headed, and tricolored nuns, the spicebird or chestnut finch, and others. Most of them have more or less dark brown in the coloring. A pure white variety and a buff and white variety of one species—the Japanese nun, also known as bengalee or mannikin—bear testimony to the assiduity of Japanese breeders.

An attractive singer that seems to be growing in popularity is the shama thrush from India. Its song suggests by turns those of catbird, bobolink, and brown thrasher, but contains some clear mellow tones not in the repertoire of those singers.

A few bulbuls are brought from India, mainly red-vented bulbuls, but including other kinds. These do not include, however, the famous bulbul of Persia, the oriental counterpart of the European nightingale, and they add comparatively little to the total number of songsters imported.

The hill minas of India, like parrots, can be taught to talk, but very few are imported. These retail at $17 apiece.

AFRICAN BIRDS.

Most of the cage-birds from Africa, which are brought to London, Liverpool, Marseille, Bordeaux, and other European ports in immense numbers, are secured for beauty of plumage, not song. The African weavers, 994 of which were imported during the year, in addition to attractive coloring offer an interesting exhibition of their skill in the art that has given them their name. At nesting time, if furnished with worsted or other suitable material, they will weave this in and out of the wires of their cages, making neat and compact examples of their handiwork. Bishops and Madagascar weavers are brilliant red and black in coloring, cut-throats have a band of red across the throat, from which is derived the name, and whidah birds (incorrectly called "widow" birds) have extremely long tails. The group furnishes an instance in which one family contains both bishops and cut-throats. A Napoleon also figures among its members, and all are frequently associated with Japanese nuns and Brazilian cardinals.

Waxbills numbered 555 in the year's importations. These include the dainty little cordon bleu, or crimson-eared waxbill, various species of silverbills, and several other kinds. The violet-eared waxbill, a bird of radiant, prismatic beauty, is brought to England, but has apparently not yet come to the United States. The tiny zebra finches, easy to keep and breeding readily in captivity, are favorites with the bird-keeping public, 591 coming in during the year. African siskins are also somewhat popular, and a small but increasing number of edel-singers, or African gray singers, one of the few African species that have a pleasing song, are imported annually.

African birds generally bring $1.50 a pair at wholesale. Most of them have light, unmusical, but not disagreeable, notes, and being bright and active, give life to room or aviary where they are confined. While the breeding time of most of them is during our winter (the seasons being reversed south of the equator), many of the little immigrants adapt themselves readily to the changed conditions and breed in the summer of the North Temperate Zone.

AUSTRALIAN BIRDS.

Ordinary Australian birds also sell for $1.50 a pair wholesale. Of these, apart from shell parrakeets, diamond sparrows are imported in the largest numbers, the year's supply being 332.

Australia is notable, however, for its charming Lady Gould finches, which, perhaps, reach the highest point of beauty and elegance attained by any of the smaller cage-birds of the world (see Pl. IX). Few are sold in this country, possibly because of their high price—$9 to $10 a pair at wholesale—and because they are difficult to keep (an English fancier says of them that they suffer all the ills that beset other cage-birds and several special ones of their own). They are highly prized

A. HOEN & CO. BALTIMORE.

LADY GOULD FINCH.

in England, where they have been bred a number of times. The main reason for their unusual mortality seems to be improper treatment. Because they come from the warm climate of Australia, they are usually kept where they have plenty of sunlight. As a matter of fact, however, as recently pointed out by a writer in "Bird Notes," they inhabit dense scrub, and in their natural habitat avoid the direct rays of the sun. To place them in a small cage in the sunlight is a very effective method of destroying them. Lady Gould finches are attractive in their ways as well as in appearance. They tame readily, are not pugnacious with cage mates, and exhibit many individualities of disposition. They have a very interesting little dance that sometimes forms a part of their courtship.[a]

BIRDS FROM SOUTH AMERICA, MEXICO, AND CUBA.

Omitting parrots, gray cardinals are the principal cage-birds imported from South America. In England these vie in favor with our own cardinal, from which they differ in being gray in color, with no red excepting about the head. During the last fiscal year we imported 455, which were retailed at $3.50 each. A number of different species of small birds are annually brought from Mexico and Cuba, but none in important numbers except tomeguinos, known also as grassquits or melodious Cuban finches and olive Cuban finches, according to species. These sell for $1.50 a pair wholesale, and 665 entered during the year.

BIRDS BRED IN CAPTIVITY.

In Europe, as has been stated, great interest is manifested in breeding cage-birds. This interest attaches to the propagation, not only of rare birds, but of many species that are commonly found in aviaries. There is a great difference in the ease with which birds may be bred in captivity. Some, such as shell parrakeets, zebra finches, Java sparrows, strawberry finches, and our own bluebirds and indigo birds, breed readily and their young can be raised without much difficulty. But some of the parrots and small cage-birds refuse to mate, others will not sit on their eggs, and others yet neglect their young. To breed such species requires much patience and ingenuity, and success is valued accordingly. In the United States, where bird-fanciers are few and lack association, there is not the same general interest in the breeding of captive birds. Few Oriental birds other than Java sparrows and but few of the small cage-birds from Africa and Australia have been successfully bred in the United States. Among the more important birds that have been reared in this country are the canary, shell parrakeet, black-crested mina, all-green parrakeet, gray parrakeet, cockateel, graceful ground-dove, barred-shoulder dove, zebra finch, white

[a] See a detailed account of this dance by Captain Perreau in "Bird Notes" for November, 1905, Vol. IV, No. 8, p. 203.

Java sparrow, gray Java sparrow, cut-throat finch, and saffron finch. Some hybrids have been produced by breeding canaries with goldfinches, linnets, and other birds, thus securing well-known and greatly valued mules.

OPPORTUNITY FOR AMERICAN ENTERPRISE.

The large and rapidly growing demand for canaries and other cage-birds that has sprung up in the United States and that is now satisfied by importations from abroad suggests the possibility of establishing the industry of raising birds for market on this side of the Atlantic. It is more than likely that interest in the keeping of cage-birds will continue to spread, and that its growth will result in the development of societies, periodicals, annual shows, and other features that mark its advance in Europe. Breeding canaries for market brings, as has been shown, several hundred thousand dollars annually to the peasants of the Harz Mountains of Germany; canaries of fancy shapes that command high prices are regularly bred in England, Scotland, Belgium, and other countries; and it is important to note that in nearly every instance the pursuit is carried on as an adjunct to some other occupation. There is no reason why the American market should not be supplied by American breeders. The need already exists; imported birds are not so well adapted to our climate as those raised here, and home production would obviate the large losses incident to the ocean voyage.

Many difficulties must be met. Captive birds are subject to numerous diseases and, under the most favorable circumstances, require careful treatment. Attention to diet is important, particularly in the case of soft-billed birds, whose food is chiefly insects. Questions of suitable temperature for aviaries, of securing sufficient open-air exercise without undue exposure, of preventing destruction of birds or their eggs by cage-mates, of inducing birds to breed, and many other problems constantly tax the patience and skill of the aviculturist; and owing to climatic differences between Europe and America many of these questions would doubtless have to be settled anew.

But American ingenuity and energy should be able to meet and overcome all obstacles and establish the business on a paying basis. Due weight should be given the fact that the experiment requires little capital. It can easily be started at small expense and extended only as the profits justify extension. The field is a promising one. The success attending cage-bird breeding in Europe, the great demand for birds as pets in this country revealed by our large importations, the superior value of those bred in America, and the facility with which the business can be established and maintained offer strong inducements to American enterprise.

THE USE OF SOIL SURVEYS.

By J. A. Bonsteel,
In Charge of Soil Survey, Bureau of Soils.

The soil of the United States constitutes the one great inexhaustible natural resource of the country; from it spring not only the food and raiment of the people, but nearly one-half (42 per cent) of the materials used in manufacture and a majority of the materials exchanged in commerce. From the soil, in the present generation, the farmers of the United States have won a living for themselves and for their countrymen, and in addition have furnished the commodities whose sale and exchange have much reduced the dependence of this country upon the capital of foreign nations.

SMALL PROPORTION OF LAND UNDER TILLAGE.

The agricultural domain of the United States (exclusive of the outlying possessions) in 1900 comprised 5,739,657 farms, aggregating 841,201,546 acres. Of this area almost exactly one-half is improved land and the remainder consists of woodlots, swamps, and land that has never been plowed or cropped. Although this is a great total, less than one-half of the whole land area has been turned into farms, and less than one-fifth is actually improved. Even upon this showing the farm lands of the United States comprise seven times the farm-land area of France, with 39 million people; eight times the farm-land area of Germany, with 60 million people; and thirty-one times the farm-land area of England and Wales, with 34 million people. The American farms now existing could be made to produce enough to feed many times the country's present population were the best and most intensive agricultural methods of European countries applied, and still have a surplus for export.

It is to the full development of these vast but dormant resources that the soil-survey work is devoted.

SOIL RESOURCES MAY BE GREATLY INCREASED.

The soil itself is not a fixed and generally decreasing source of income, as are many of the other natural resources of the country. The wealth of the soil may not properly be compared with a fixed bank account upon which drafts in the form of crops are continuously

drawn with the ultimate result of the complete exhaustion of the capital involved. The soil is more nearly comparable with an invested fund whose annual interest is paid in the form of crops and which, under proper management, may be continually increased from its annual earnings. The forces of nature which have produced soils have not ceased to act, and through their steady, continued operations they are capable of maintaining and renewing the producing power of this great natural resource when they are properly directed and assisted by the husbandman. In this respect soils, as a natural resource, differ most materially from mines. The mine of metal or of mineral fuel constitutes a resource whose extent may be ascertained and whose total content may be measured. It is possible under certain conditions for skillful engineers to estimate with considerable exactness the total amount of material which may be removed from a mine and the length of time which it will continue to yield. With the soil this is not possible. Even where surface soils are bodily removed and useless subsoils are exposed, these, if only left to nature, may in time be brought to useful productivity; when nature is properly assisted the process becomes rapid. When through mismanagement the crop-producing power of a soil is impaired, a simple change in crop rotation or in the mechanical handling of the soil is often sufficient to make its continued cultivation possible and profitable. Thus the soil, under businesslike and scientific management, is capable of yielding not only annual but annually increasing profits. While bad management, neglect, or avarice may cause a temporary check in the producing capacity of the individual field, history shows and statistics prove that, in all civilized countries, through all historic times, the soils of the world have responded with increased crops to increasingly intensive culture for the support of growing populations. It is only within brief periods of time and over limited areas that improvidence or neglect has been able to cause decreased returns from the soil.

The time has not yet arrived when even the present known resources of American soils are fully called upon to feed the people of our own nation. No such intensity of cultivation is demanded as in Germany, where the average farm comprises 19 acres, or in France, where it is 34 acres, nor even as in England and Wales, where it is 63.4 acres. In the United States land is still so abundant that the average farm contains 146.2 acres and less than half of it is improved. The time may some day come, and doubtless will—it may be when there are 300 millions of Americans instead of 85 millions—when more land will be needed for farms. Much sooner will come a time when the farm land now in use must be handled more intensively and more effectively and each acre must be made to produce to its maximum capacity the crops for which it is best fitted.

STUDY OF LARGE PROBLEMS.

It is partly in anticipation of that time that the soil survey is examining into the total soil resources of the country and investigating the broad problems of the relationship of soil to crop, which must be solved before American soils and American farmers can do their best, the one for the other. In crop production, even under ordinary farm methods, there are two groups of influences which control the selection of appropriate crops—the planning of crop rotations and the adoption of correct systems of farming. These are the influences of the climate and the soil. Neither may be neglected by any man who hopes for complete success, and the due and relative importance of each must be ascertained.

EXTENT OF SURVEYS ALREADY MADE.

The work of making soil surveys was begun in 1899, and by June 30, 1906, an aggregate area of 118,686 square miles, or 75,959,865 acres, had been mapped. This comprises something less than one-tenth of the area actually in farms and about one twenty-fifth of the entire area of the United States. These surveys have been made in 43 States and 4 Territories. They have been so distributed as to constitute numerous studies of each important geographical and agricultural district.

SOIL TYPES, SERIES, AND PROVINCES.

The work of the soil survey is based upon the principle that there are differences among soils which so affect plants that not all soils are equally suited to the production of all crops. This work, therefore, comprises a study of both the character of these soil differences and the effects which they produce in the growing of farm crops.

In the field work of the soil survey the soils are studied to determine their texture, or the relative amounts of coarse or fine particles of which they consist; their structure, or the relationship of these particles one to the others; their organic matter content, both quantity and distribution; their internal natural drainage, and their topographic relief. These factors operating together determine the character of the home which plants are to find in the soil. All masses or areas of soil which are found to be closely similar in all of these respects are said to belong to the same soil type. Under similar climatic surroundings the type is capable of producing similar kinds of crops, and under the same conditions of farm management and of farm efficiency they may be expected to produce practically equivalent amounts of crops.

It has also been found that several soil types in a given region may differ only in their texture, being identical or similar in all other

respects. Such a group of soils is called a series. Again, several series have been found to be derived from the same classes of material by similar processes and to exist in a region having similar climatic features in the broadest sense. Such a region constitutes a soil province.

EXTENT OF SOIL TYPES.

The soil survey recognizes at present 13 great soil provinces, 58 soil series, and 461 soil types. Of these types some 130 are more or less local in character, while the remainder are of widespread occurrence within their respective provinces. For example, the Norfolk sand is a warm, porous soil of the Atlantic and Gulf Coastal Plain Province, suited to the production of truck crops. This type has been mapped in 34 different areas, located in 14 States, extending from New England to Texas. The total area covered by this type in the areas mapped amounts to 1,702,000 acres, or 2,660 square miles. Its extent within the total area of these 14 States is many times as great. Throughout the region where it occurs this soil has a definite crop adaptation, and the variety of crops which may be raised sucessfully upon it is limited by nature.

Similarly the Marshall silt loam has been mapped in 22 areas, located in 9 different States, to an extent of 3,921,000 acres, or 6,126 square miles. It is again safe to say that within these States several times as many acres exist as have been mapped. Seven-eighths of the area of this soil is preeminently adapted to corn production, and the remaining one-eighth, while under climatic surroundings unfavorable to corn, is well suited to the production of one or more other crops of equal value.

Although these two types of soil are extreme cases, they are by no means the only valuable soils of wide distribution and well-recognized crop adaptation. Among the other 459 types there are some of which areas as large as the smaller States have already been mapped. There are others of which areas scarcely larger than a single township have so far been encountered and mapped. Whether extensive or limited in area, each presents its own peculiarities and no two could safely be classed together as possessing identical properties and the same utility.

ADAPTATION OF CROPS TO SOILS.

Enough has been said to demonstrate the wide range and the wonderful richness of the soil resources of the country. The other problem of equal importance, possibly the greatest agricultural problem of the nation as a whole, is that of the proper and complete development of these resources along lines which shall give not only increased crop values, but also increasing ability to produce crops upon the part of the soils.

Careful consideration must be given to the fact that at least 461 types of soil possessing distinctive properties are already known to exist. It rests with some one, whether a private individual or a public official, to determine the crop or crops to which each one of these soils is best adapted; to devise the methods of soil management by which each one of these soils may be made to produce a sufficient crop to repay all expenses and to render a profit; to adapt the systems of farm economy through crop rotations, tillage, and fertilization so that these different soils may produce their crops for long periods of time at least without deterioration and, if American farming is to become a science, with actual increase in crop-producing power.

Moreover, it is necessary that the discovery, introduction, and culture of crops adapted to these various types shall follow such lines that the greatest food values as well as the highest commercial values shall be rendered by each soil. It is also a necessity that upon widely extended types such crops shall be grown as are subject to wide demand in the markets of the world. Otherwise the farmers engaged in crop production must face a destructive competition or else portions of the soil type must be neglected or but feebly utilized. One may anticipate the time when all areas of Norfolk sand having suitable climatic conditions and transportation facilities can be made to produce great crops of those vegetables which now constitute winter luxuries for the few. At the present day such widespread production, coupled with a limited demand, would force prices to a point where the returns from the crop would only pay the charges of transportation and of retailing and the producer would be left with neither expenses nor profits paid. Therefore, before such anticipations can be realized, either demand must increase, as it will with increasing population and individual wealth, or transportation costs must diminish, as they also will with the progress of invention and a proper increase in competition.

The soil-survey work thus possesses a dual aspect: (1) It must deal with those problems of crop and soil adaptation which concern the present individuals and generation; and (2) it must accumulate a fund of information in regard to soils which will assist in solving the broad problems of the nation's soil resources and the utilization of these resources, not only for the support of a growing population, but also for maintaining a favorable balance of trade for the nation.

REPORTS ON ACTUAL USES OF SOILS.

The individual report upon each soil-survey area contains an account of each soil type within the area. It gives a description of the characteristic appearance of the type and summarizes the crop uses to which it is put within the area. The methods of handling the soil are given, and a general statement is also made of the range of

crop production. Such a report summarizes the actual uses of the soil within these restricted limits, and it also summarizes the farm practices in the given region. Each report also contains an account of the crops raised in other areas where the same type of soil has been encountered; and suggestions as to new crops, new methods of soil management, and new industries are made as a result of this wider knowledge secured from numerous surveys.

PRESENT USES OF SOIL REPORTS.

From these reports on soil surveys the individual farmer may learn the relationships of the soils upon his own farm, not only to the other soils in the immediate neighborhood, but to soils of the same character in widely separated regions. He may thus observe and study understandingly the methods and results obtained under the most favorable conditions by successful farmers upon these soils. His horizon of observation is enlarged, and he may more surely apply the experience and the observation of others to his own particular needs and conditions. He is able to consider his own farm, not as an isolated property, but in its due relationship to other farms located upon the same soils and in a region of similar climatic surroundings. The single report thus serves the purpose of the individual whose problem is one of a fixed and occupied region.

At the present time, as at all times in the history of the country, there is a large class of persons who for various reasons desire to secure new farms in more or less distant localities for the pursuit of general agriculture or for the production of special crops. Inquiries from such persons always cover certain climatic and soil features, and each desires to secure information which will enable him to compare conditions personally known to himself with those of new locailties under consideration. Inquiries of this nature are constantly received at the Department of Agriculture, and wherever possible the information is supplied by the reports and maps covering the areas concerned. No advice to do this or that is communicated; only the information upon which a judgment may be based. The use of soil-survey reports for this purpose is by no means confined to reports upon regions which are sparsely settled or newly opened for agricultural occupation. The constant changes in farm values in all parts of the United States are calling the attention of individual farmers to particular localities in the older States where possible advantages may be gained from the sale of high-priced lands and the purchase of others which, for the time, are offered at a lower figure. Greater demands have been made during the past few years for soil-survey reports covering areas in the Eastern and Southern States than for those in any other localities. Whatever the cause, the attention of individuals and of investors is strongly shown by this demand.

During the past decade the funds accumulated by large investment companies have increasingly sought a farm-land outlet. The soil-survey reports are regularly requested by many such companies. Some only desire the reports in particular circumscribed regions. Others desire these reports as an unprejudiced basis upon which a judgment of land uses and of farm development in widespread and remote regions may be based. Obviously, the common interest of the entire community is served by these reports of soil facts, just as the individual interests of the persons concerned are safeguarded at the same time.

The use of the soil-survey maps and reports by educational institutions has greatly increased within a few years, accompanying a renewed activity in the study of soils and in the teaching of soil subjects. Not only are the maps and reports used by those institutions directly for the study of soils, but they are also used in studies of crop production, of farm economics, and of the distribution of agricultural products. Nonagricultural colleges and universities are also using these reports in connection with courses in commercial geography. It has thus become necessary to hold such uses in mind in the distribution of the individual soil-survey reports and of the annual report known as Field Operations of the Bureau of Soils.

FUTURE NEED FOR EXACT INFORMATION.

All of these uses of soil maps and of soil-survey reports are immediate and present. They are more or less personal to the individual farmer, investor, or student. They do not constitute the only use nor possibly the greatest use of these surveys. As agriculture, based on the soil as its fundamental resource, is the greatest business of the country at the present time, so it must remain for many generations to come. Agriculture is still a generalized business, although its specialization into horticulture, market gardening, tobacco culture, cotton culture, and other subdivisions has begun. With increasing population, with greater intensity of cultivation, greater demands will continually be made upon the soil and greater precision and skill in the selection and handling of soils for special crops will be required. It will be extravagantly wasteful to allow these developments to occur along the lines of chance and to secure the ultimate ends as the result of haphazard trial or experimentation. The soil and climatic factors which govern plant and crop growth must be understood and appreciated. Whenever through any cause a particularly valuable crop is brought to perfection upon a given soil, the extent and geographic distribution and the climatic environment of that soil must be known in order to insure the successful spread of its culture.

Even at the present day there is continual inquiry as to the soil conditions under which specific crops may be successfully grown, and

crops formerly confined to narrow regions are spreading to other localities. The culture of alfalfa, the production of sugar beets, the introduction of new varieties of tobacco or of old varieties into new regions, all illustrate this tendency. Discussions of soils in connection with the great staple crops are usually confined to corn soils, wheat soils, cotton soils, or grass soils. Little attention is paid to the pertinent fact that each of these crops has developed well-marked varieties suited to quite different regions, climates, and soils. It has become necessary to study not tobacco soils, but cigar-wrapper tobacco soils or cigar-filler tobacco soils. This is recognized. The equally important fact that corn and wheat, cotton, rice, and the other great staples should be studied as varieties adapted to different kinds of soil has not been equally emphasized.

From the study of American soil differences, soil adaptations, and soil resources, and from the long-continued observation, classification, and correlation of soil and crop facts, may be ascertained by the specialist new uses, now unperceived, of each and every acre of agricultural land, so that statistics will no longer report less than one-half of the land of the country apportioned into farms and less than one-fifth actually improved and tilled. From these studies and from the development of laws of soil and plant association it will undoubtedly be possible, at some future day, to increase the number of great staple crops from a scant dozen to several score, each occupying its proper place in the farm economy of the country and each produced under those circumstances of soil and climate best fitted to its growth.

Those other problems, even now appearing in American agriculture, of the rehabilitation of so-called "worn-out" and abandoned farms, of maintaining and even increasing the producing capacity of broad areas, while they are probably economic and farm-management problems to a considerable extent, are only capable of solution after a thorough study of the soil conditions in the field. These problems may not even be outlined without the aid of soil-survey work; much less can they be solved.

The time has come in the agricultural development of the United States when accurate and detailed knowledge of the soil—its character, varieties, capabilities, and adaptations—is of great importance; and as the years go by such knowledge will become more and more important, until ultimately our greatly increased population will need and will be able to utilize fully the diverse capabilities of these 461 different types of soil.

BIRDS THAT EAT SCALE INSECTS.

By W. L. McAtee,
Assistant, Biological Survey.

INTRODUCTION.

The importance of birds to the farmer in his warfare against insects is everywhere recognized; indeed, it may be said that successful agriculture would be well-nigh impossible without their aid. One important rôle, however, is filled by birds, in which the value of their services has not been appreciated, chiefly, no doubt, because the facts are not generally known. This is as destroyers of scale insects. Very little has been published on the subject, although at least six foreign species and about the same number of native ones have been reported as feeding upon scales. These facts have been either overlooked or little weight has been attached to them. Indeed, only recently currency has been given to a statement that birds never feed upon scales. Not only is this statement not true, but investigations by the Biological Survey prove conclusively that scales are eaten by many species of birds and that with some species they are a favorite food.

DAMAGE TO TREES AND CROPS BY SCALE INSECTS.

Before attempting to estimate the value of the services of birds in reducing the number of scale insects, it will be well to review briefly the nature and extent of the damage inflicted by these pests. Many authorities class the scales among the most destructive of insects. They have caused the loss of hundreds of valuable orchards and are dreaded by the horticulturist above all other insects, being especially feared because of the insidiousness of their attack. When present in small numbers they are easily overlooked and thus may become firmly established in an orchard before their presence is detected.

When young and still more or less active, scale insects are carried from tree to tree by numerous agencies, and hence spread with great rapidity. When adult they firmly attach themselves to the plant, upon the sap of which they feed, and their combined attacks gradually reduce its vitality till finally death ensues. Many varieties of plants are infested by them, and often large trees are completely incrusted by a mass of scales composed of hundreds of thousands of individuals. Even perfectly healthy trees do not survive the attacks of these minute pests more than two or three years.

In such extreme cases all methods of relief generally fail, and when once the vigor of a tree is seriously impaired by scales there is no remedy. The old growth must be cut down and burned and new stock introduced. In most instances of scale attack, however, the problem is less serious, and various suppressive measures are effectual. It is during the lighter infestations that the controlling power of natural enemies of the scale is most apparent.

NATURAL ENEMIES OF SCALE INSECTS.

In extreme cases of infestation by scales their natural enemies are rarely able to control them, at least until the insects have done much damage. The greatest value, therefore, of the natural enemies of scales is in preventing undue increase of the insects, in restraining them within what may be termed natural bounds, when the harm they do is comparatively of little moment.

As an example of a species usually harmless but occasionally increasing beyond the limit of safety, the plum scale (*Eulecanium cerasifex*) may be cited. Of this species Lugger, in a report on Minnesota insects, says: "This is usually an uncommon species, but is now found in destructive numbers, not alone upon the cherry, but also more frequently upon the plum; though apples, pears, and other trees do not escape."[a]

The plum scale is injurious also in New York, but in many parts of its range it is not numerous enough to be a pest, which indicates that in these localities its enemies have been able to hold it in check and thus maintain the balance. This is the ideal state. Under primitive conditions a balance among organisms, both animal and vegetable, was more frequent and more stable than it now is, when man's interference with the operation of natural laws, destroying some species and protecting and propagating others, constantly disturbs the equilibrium.

Owing to various changes, among the most important of which has been the importation of unlimited numbers of foreign scales, which, for a time at least, have enjoyed almost entire immunity from natural enemies, the balance between scale insects and their enemies has been most seriously affected, and the scales have increased enormously. Hence in attempting to reduce the numbers of scale insects every effort should be made to foster their natural enemies.

For the purpose of considering their economic value, the latter may be divided into two groups—the parasitic and the predaceous enemies. So effectively do the parasites (in great part minute Hymenoptera) wage war against scales that they sometimes destroy not less than 85 per cent of the pests, together with their eggs. Nevertheless, as has been stated by Dr. L. O. Howard, "it is perfectly obvious that these

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[a] Bul. 69, Agr. Exp. Sta. Univ. of Minn., p. 217, 1900.

parasites will not accomplish complete extermination." However, they do not have to fight the battle alone, for as allies they have the group of predaceous enemies which comprises beetles, syrphus and lace-wing flies, and true bugs among insects, and also mites, birds, and mammals. Among these, beetles are undoubtedly the most important. Coccinellid beetles, or ladybirds, of many species feed upon the scale insects, and in their ranks are the most successful destroyers of scales known. One of them almost completely exterminated the cottony cushion scale, formerly the most destructive insect of its kind in California.

Mammals may be dismissed in this connection with the statement that so far as known they count for but little in the warfare against scales: one instance is known of mice devouring the Lecanium scales from a peach tree in England.

As was noted in the introduction, comparatively little has found its way into print as to the part birds play as destroyers of scale insects. Among the most interesting published observations on this point are those of R. Newstead, Chester, England.[a] He mentions four scale insects which were preyed upon by five species of birds, and it is to be noted that two of the scales and two of the birds are identical with species occurring in the United States. The house sparrow was found apparently feeding upon the hawthorn scale (*Eulecanium genevense*), which occurs only in Europe. Another scale insect, nevertheless, and an injurious one, the oyster-shell bark-louse (*Mytilaspis pomorum*), which was eaten by the birds Mr. Newstead studied, is a common pest in the United States. It was fed upon by the tree-creeper, a near relative of our own brown creeper. The English author says:

> Many times I have seen, with the aid of field glasses, the tree creeper (*Certhia familiaris*) collecting this species during winter and spring; and from what I have seen of the marsh tit (*P[arus] palustris*) and the blue tit (*P. cæruleus*), they, too, are fond of the species.

He found a few of these scales likewise in the stomach of the long-tailed tit (*Acredula caudata*). The latter bird, together with the blue tit, fed also upon another scale insect which occurs in the United States. This is a golden-colored scale (*Asterolecanium variolosum*), which is sometimes injurious to shade trees. Newstead says:

> I firmly believe this species is eagerly sought for by various species of tits. Here, in Cheshire, the characteristic little depressions made in the twigs of the oak by this species are to be found in thousands. Rarely is it that the Coccids are found in them. This fact for many years led me to suspect the birds had taken them. It was not until 1894 that the matter was placed beyond doubt [by stomach examination]. The May record is of the greatest interest, as at that time there would be a good selection of bird food. It proves, therefore, that the species is a selected item in the dietary of the two species of birds.

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[a] The Entomologist's Monthly Magazine, 2d ser., VI [XXXI], pp. 84–86, 1895.

It is significant that the fourth species of scale insect (*Aspidiotus zonatus*) found by him in the stomachs of birds is related to the notorious San Jose scale. It was eaten by the blue tit (*Parus cæruleus*). Among other foreign birds known to feed upon scales is a South African species, the white-eye (*Zosterops capensis*), which selects the larger soft scales (Lecaniinæ).

Recent investigations show that a very much larger number of our North American birds prey upon scales than was expected, and some eat them to a considerable extent. Their influence upon the number of these pests, while doubtless less than that of the predaceous insects, is of far more importance than has yet been recognized. Among the scales they devour are some most notorious pests.

SCALES EATEN BY NORTH AMERICAN BIRDS.

At least two native birds eat the plum scale, which is destructive to cherry and plum trees. One of them is the beautiful rose-breasted grosbeak (*Zamelodia ludoviciana*). A female of this species collected by the writer in Indiana had eaten 36 of these scales, composing 95 per cent of the stomach contents. Two other grosbeaks from Illinois did still better. One consumed about 45 plum scales, which made up 95 per cent of its food, while the other had eaten nothing but plum scales, of which its stomach contained more than 100. The cardinal or redbird also feeds upon the plum scale, one taken in Texas in April having consumed a number sufficient to form 84 per cent of its stomach contents.

These two species of birds devour other scale insects also, some of which are closely related to the plum scale. The rose-breasted grosbeak has been found to eat the hickory scale (*Eulecanium caryæ*) and the tulip scale (*Eulecanium tulipiferæ*). The latter is very destructive to shade trees in some parts of the eastern United States. While both the rose-breasted and the cardinal grosbeak eat scales of the genus Eulecanium in large numbers, we have been unable to identify specifically any others, with the probable exception of the locust scale, *Eulecanium robinarium* (Douglas), from the stomach of a cardinal collected in Texas. Another grosbeak, the black-headed (*Zamelodia melanocephala*), at home in the western United States, preys upon scales of the same genus. It is known to select the frosted scale (*Eulecanium pruinosum*), which attacks fruit trees such as apricot, peach, prune, and cherry, and is already important economically, with possibilities of becoming a serious pest if unchecked. It relishes also the apricot scale (*Eulecanium armeniacum*), which is an enemy of apricot, prune, pear, and other trees.

In the southeastern United States occurs an allied genus of scale insects, Toumeyella. The cardinal feeds upon at least one species of this group.

Distributed chiefly along the Pacific coast is a scale which is closely related to those of the above-mentioned genera and is preyed upon by many birds. This is the black olive scale (*Saissetia oleæ*, fig. 1). Its great economic importance is emphasized in the following quotation from Mr. C. L. Marlatt, of the Bureau of Entomology:

> The most destructive insect enemies of fruits in California are undoubtedly the scale insects, few if any other insects, aside from the grape Phylloxera, at all approaching them in this respect. Of these the ones of greatest moment, and in the control of which vast sums of money are expended, are the black scale, the red scale, and the San Jose scale. * * * Of the three, * * * the most serious pest at the present time in California is undoubtedly the black scale. * * * This insect is not only a heavy drain on the vigor of the trees, but exudes a great quantity of honeydew, in which a fungus propagates, creating a black, stifling deposit, which adheres closely to the twigs and leaves and discolors the fruit. This scale infests both citrus and deciduous trees, but is particularly injurious to the former, and also to the olive.[a]

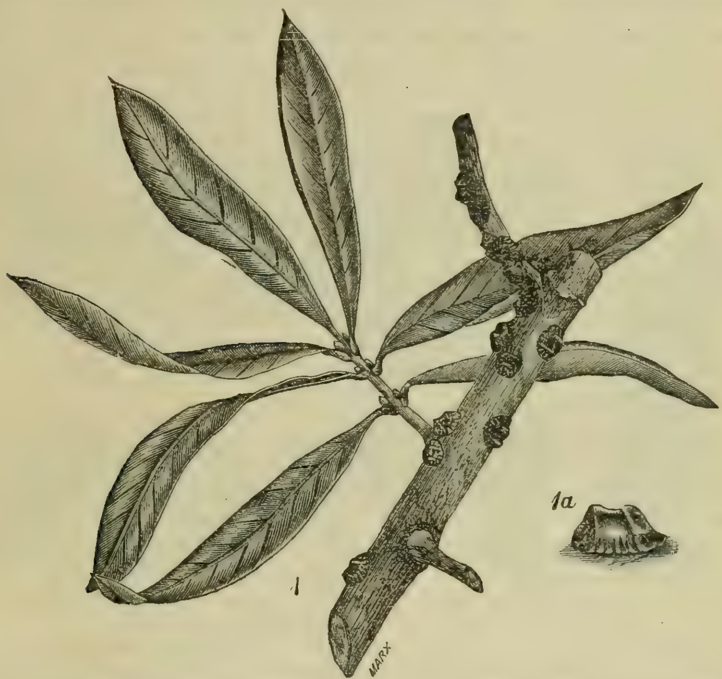

FIG. 1.—Black olive scale (*Saissetia oleæ*). (From Koebele, Bureau of Entomology, after Comstock.)

This abundant and injurious scale is at present known to be fed upon by no less than 29 species of birds, and their importance in checking its increase can not be overlooked. These include three woodpeckers, a jay, an oriole, five sparrows, four vireos, six warblers,

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[a] Yearbook U. S. Dept. of Agriculture, 1896, p. 220.

two wrens, a nuthatch, four tits, a gnatcatcher, and a bluebird. Several of them consume the black scale in great numbers, the two most conspicuous in this respect being the black-headed grosbeak and the bush-tit (*Psaltriparus minimus*). Eighteen per cent of the entire food of 120 grosbeaks consisted of black olive scales, while 21 per cent of the year's subsistence of more than 350 bush-tits was of the same nature.

The work of birds upon the black scale is so conspicuous that it has attracted the attention of field observers. In a letter to the Biological Survey, F. S. Daggett says (March 17, 1903):

> A thick top of pepper tree is opposite a window of my house. It is infested by black scale, and the past few years I have noticed several varieties of birds going through the top, carefully picking off scale. Audubon warblers do it, especially when it is cold and no insects are flying; when it is warm they stay about the top, flying out after insects, but do not seem to take the scale. The intermediate sparrow, however, is commonly seen in small flocks working on this scale, and they go through many gymnastic motions, not expected in a sparrow, in order to get at the scale on the underside of the twigs. The top is scarcely 10 feet from the window and I have watched them closely. There is an overgrown cypress hedge under one side of the tree, from which the sparrows work up.

Prof. F. E. L. Beal, of the Biological Survey, while at Haywards, Cal., May, 1906, noted particularly the relation of birds to this scale. He writes: "I have proved that they eat them freely."

Following is a list of the birds which thus far are known to feed upon the black olive scale:

Willow woodpecker (*Dryobates turati*).
Nuttall woodpecker (*Dryobates nuttalli*).
California woodpecker (*Melanerpes f. bairdi*).
California jay (*Aphelocoma californica*).
Bullock oriole (*Icterus bullocki*).
Intermediate sparrow (*Zonotrichia l. gambeli*).
Western chipping sparrow (*Spizella s. arizonæ*).
Spurred towhee (*Pipilo m. megalonyx*).
California towhee (*Pipilo crissalis*).
Western warbling vireo (*Vireo g. swainsoni*).
Cassin vireo (*Vireo s. cassini*).
Hutton vireo (*Vireo huttoni*).
Least vireo (*Vireo pusillus*).
Yellow warbler (*Dendroica æstiva*).
Myrtle warbler (*Dendroica coronata*).
Lutescent warbler (*Helminthophila c. lutescens*).
Audubon warbler (*Dendroica auduboni*).
Pacific yellowthroat (*Geothlypis t. arizela*).
Golden pileolated warbler (*Wilsonia p. pileolata*).
Black-headed grosbeak (*Zamelodia melanocephala*).
Cactus wren (*Heleodytes brunneicapillus*).
Vigors wren (*Thryomanes b. spilurus*).
Slender-billed nuthatch (*Sitta c. aculeata*).
Plain titmouse (*Bæolophus inornatus*).
Chestnut-backed chickadee (*Parus rufescens*).
Wren tit (*Chamæa fasciata*).
California bush-tit (*Psaltriparus m. californicus*).
Black-tailed gnatcatcher (*Polioptila californica*).
Western bluebird (*Sialia m. occidentalis*).

Several of the above birds eat other scales, besides the one which infests the olive. One of these is the greedy scale (*Aspidiotus rapax*, fig. 2), which Dr. L. O. Howard says "was found until recently only on the Pacific coast and in the far Southwest," where "it levies a heavy

annual tax on the fruit growers," and which "has the present season [1894] made its appearance in Mississippi and Texas." [a] The greedy scale attacks both citrus and deciduous trees, infesting a very large number of food plants, among which it shows little preference, and is one of the destructive scale insects. Investigations by the Biological Survey prove that at least four species of birds—the myrtle and Audubon warblers, wren-tit, and bush-tit—devour this scale, some individuals examined having their stomachs filled with it.

Another scale insect which is eaten by several birds, but which differs from the last-mentioned species in that it confines itself to a single host plant, is the oak scale (Kermes). Oak scales are not conspicuously injurious, but this fact does not detract from the value of the birds which feed upon them, since we can be assured

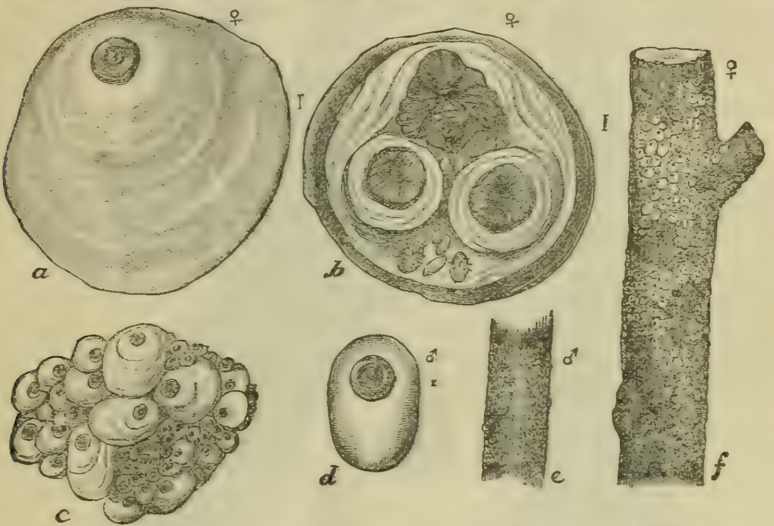

FIG. 2.—Greedy scale (*Aspidiotus rapax*). (From Howard, Bureau of Entomology.)

they do not neglect other kinds which are destructive. In fact, one of the oak-scale feeders, the rose-breasted grosbeak, is already known to feed upon other and harmful scales.

The following species of birds have been found to devour the oak scale:

Rose-breasted grosbeak.
Red-eyed vireo.
White-eyed vireo.
Worm-eating warbler.
Magnolia warbler.
Blackpoll warbler.
Canadian warbler.

The oaks, infested as they are by the comparatively innocuous Kermes, are fortunate in comparison to the maples, which are attacked by Pulvinaria. The cottony maple scale (*Pulvinaria innumerabilis*) is a special pest of the tree from which it derives its common name, but

[a] Yearbook U. S. Dept. of Agriculture, 1894, p. 249.

it is found upon scores of others. The writer once observed an infestation of this scale so severe that shade trees along the streets of a small town in Indiana, together with fruit trees, appeared almost white from the choking masses of cottony wax produced by the scale insects. Maples, poplars, and cherry trees were the principal hosts in this case. According to Dr. L. O. Howard, "birds destroy the full-grown scales, although one would hardly suppose a mouthful of wax to be very palatable." Doctor Howard "has often observed the English sparrow apparently feeding upon this species."[a]

The same little vagrant foreigner that attacks the maple scale, and about whose value there has been unending discussion, must be cred-

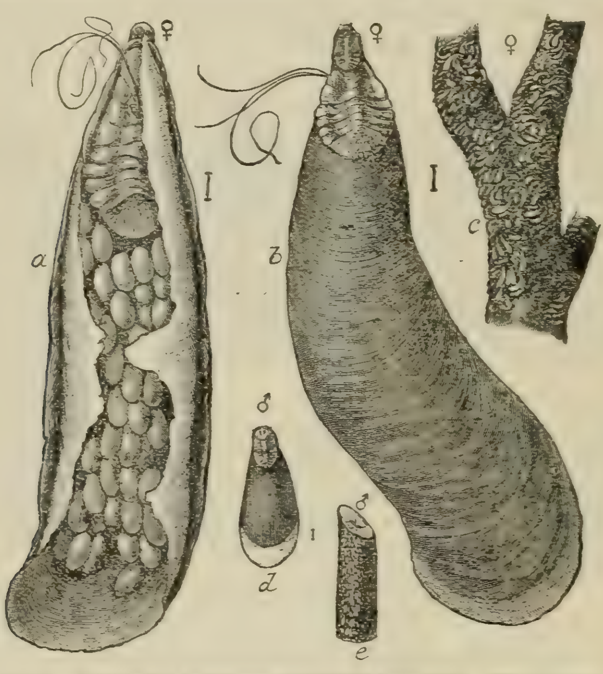

FIG. 3.—Oyster-shell bark-louse (*Mytilaspis pomorum*). (From Howard, Bureau of Entomology.)

ited with preying upon still another of these destructive pests. Dr. C. V. Riley and Dr. L. O. Howard note that "Miss Jennie R. Bush, of San Luis Obispo County, Cal., finds it destroying a scale insect upon the climbing rose."[b]

Among scale insects eaten by birds other than those above mentioned is a very abundant and widespread species, the oyster-shell bark-louse (*Mytilaspis pomorum*, fig. 3), which is sometimes quite injurious. Indeed it is said that in some sections the oyster-shell bark-louse is, with the exception of the San Jose scale, the most

[a] Bul. 22, U. S. Dept. of Agriculture, Division of Entomology, p. 12, 1900.
[b] Insect Life, V, p. 349, July, 1893.

destructive scale insect. It will be remembered that in England this scale was found to be devoured by titmice and the tree creeper. In America the same kinds of birds also select it. In regard to the brown creeper of the United States (*Certhia familiaris americana*), V. H. Lowe says:

That it feeds extensively on scale insects there is little doubt. It may often be seen on scale-infested trees both in summer and winter pecking at the scales, especially the larger ones, such as the oyster-shell bark-louse, evidently for the purpose of getting the eggs or the live scales.[a]

Of American titmice the black-capped chickadee is known to devour the same pest. In an analysis of the stomach contents of one of these birds Prof. C. M. Weed mentions "bark-lice (Coccidæ), apparently oyster-shell bark-louse (*Mytilaspis pomorum*)."[b] The white-breasted nuthatch of the same family of birds also manifests a liking for the scale. Mr. E. N. Forbush records the following concerning this species:

March 20, 1895, Mr. Bailey brought in specimens of apple twigs infested with the bark-scale louse (*Mytilaspis pomorum*). He reported that the nuthatch was feeding on them.[c]

With this insect ends the list of scales which have been specifically determined to serve as food for birds. It is to be remarked, however, that scales are difficult to identify[d] under the most favorable conditions, and in the state in which they are often found in the stomachs of birds their identification is impossible. Hence there are a number of birds which, while not mentioned in connection with particular scale insects, are nevertheless known to feed upon scales. These birds, 16 in number, include several woodpeckers, which, as their method of feeding would indicate, pick up many scale insects. The downy woodpecker is one of the most successful in gathering these minute tree pests.

Following is a list of birds ascertained to feed upon scale insects none of which were specifically identified:

Hairy woodpecker (*Dryobates villosus*).
Northern downy woodpecker (*Dryobates p. medianus*).
Red-cockaded woodpecker (*Dryobates borealis*).
Arctic three-toed woodpecker (*Picoides arcticus*).
Yellow-bellied woodpecker (*Sphyrapicus varius*).
Red-headed woodpecker (*Melanerpes erythrocephalus*).
Blue jay (*Cyanocitta cristata*).
Orchard oriole (*Icterus spurius*).
Baltimore oriole (*Icterus galbula*).
Cedar waxwing (*Ampelis cedrorum*).
Townsend warbler (*Dendroica townsendi*).
Tufted titmouse (*Bæolophus bicolor*).
Bridled titmouse (*Bæolophus wollweberi*).
Carolina chickadee (*Parus carolinensis*).
Ruby-crowned kinglet (*Regulus calendula*).
Varied thrush (*Ixoreus nævius*).

[a] Trans. N. Y. State Agr. Soc. and Bureau for Farmers' Inst. Rpts., p. 321, 1898.
[b] Bul. 54, N. H. Agr. Exp. Sta., p. 93, 1898.
[c] Mass. Crop Rep., p. 384, 1895.
[d] Mr. James G. Sanders, of the Bureau of Entomology, has named several of the scale insects mentioned in this paper and has given assistance in other ways.

SUMMARY.

All told, 57 species of birds have been found to eat scale insects. It is interesting to note that this number comprises representatives of 12 families, differing widely not only in structure but in habits. They are distributed as follows: 9 woodpeckers, 2 jays, 3 orioles, 8 sparrows, 1 waxwing, 6 vireos, 11 warblers, 2 wrens, 1 tree creeper, 2 nuthatches and 8 tits of the titmouse family, 1 kinglet and 1 gnatcatcher of the Old World warbler family, and the varied thrush and the bluebird.

At first thought it seems strange that the larger birds should take the trouble to pick up such small insects as scales. Yet the numerous representation of woodpeckers on the list and the fact that the grosbeaks among the bulkier species are most conspicuous scale destroyers prove it unsafe to assume that a direct relation exists between the size of a bird and its insect food. At the other extreme of size among scale eaters are some veritable feathered midgets, as, for example, the ruby-crowned kinglet, the black-tailed gnatcatcher, and the bush-tit, the last of which makes more than one-fifth of its food of scales.

Among the majority of these birds, both great and small, there is noticeable one similarity of habit. They are tree frequenters. On their arboreal excursions they must constantly come across scale insects, and as the latter are no doubt nutritious and are toothsome to the avian taste, it is only natural that birds should feed upon them. A few species which do not often visit trees, but which are included among the birds known to eat scales, probably secure them very rarely.

It is worthy of note that the birds thus far found to prey upon scales are practically the only species in their respective families that have been carefully studied. Thus only a few stomachs of the black and white creeper, one of the most exclusively arboreal birds in North America, have as yet been examined; and while it can not be included in the present list, there is little doubt that, in common with many of its warbler kin, it subsists partly upon scale insects. Investigation of the rôle birds play in destroying these insects is far from complete, and, bearing in mind the number of scale-eating birds of each of the families named above, it is fair to conclude that the majority of the species of woodpeckers, vireos, arboreal warblers, nuthatches, tits, kinglets, and gnatcatchers ultimately will be found to eat scale insects. The fact that 57 kinds of birds feed upon scales, 29 of them destroying one of the two most destructive species in the United States, is most encouraging

While in the present state of our knowledge it can not be claimed that birds are among the chief enemies of scales, yet they are proven to be one of nature's means of keeping these insects in check, and there is no doubt that their aid is important.

THE EFFECT OF CLIMATIC CONDITIONS ON THE COMPOSITION OF DURUM WHEAT.

By J. A. Le Clerc,
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IMPORTANCE OF DURUM WHEAT.

The growing importance of durum wheat in this country, as shown by the ever-increasing acreage devoted to its culture (the season of 1906 yielding a crop of over 50,000,000 bushels), makes this kind of wheat a profitable subject of investigation. When one considers that it is only since 1899 that any systematic attempt has been made to propagate this valuable crop in the United States,[a] the value of the investigation to our agricultural interests is evident.

Durum wheat (*Triticum durum*, in contradistinction to *Triticum vulgare*, under which name ordinary spring and winter wheats are known) is grown extensively in Russia, Algeria, Italy, and Spain. In this country it flourishes remarkably well in the Great Plains areas of the Middle West, where the climate is hot and dry, similar to that of those European countries whence this wheat was obtained.

Durum wheat is a hard, flinty, translucent grain, very rich in gluten and comparatively rich in sugars. The grain is long, and may be either dark or light in color, according to the variety and the conditions under which it is grown. It is somewhat poorer in gliadin than the best bread wheats. Like other good varieties of wheat, durum or hard wheat is one of the most nutritive and healthful of human foods, containing as it does protein and nonnitrogenous substances in almost the ideal ratio for maintaining the body in a normal condition, the gluten (protein) being used in repairing waste body tissue, and the fat, starch, etc. (nonnitrogenous substances), furnishing the heat and energy required by the system. On account of its highly glutenous nature it is extensively used, especially in Italy and France, in the manufacture of macaroni, vermicelli, and other edible pastes. For this reason it has been called "macaroni wheat." There is likewise a growing demand for durum wheat on the part of millers here and abroad, both for making straight durum flour and for mixing with the softer and less glutenous varieties in order to improve the quality of the flour, making these wheats, therefore, valuable as bread wheats.

[a] U. S. Dept. Agr., Bureau of Plant Industry, Bul. 3, Macaroni wheats, and Bul. 70, The commercial status of durum wheat. Carleton. The influence of environment upon the composition of cereals is now the subject of cooperative study by the Bureau of Chemistry and the Bureau of Plant Industry.

For these reasons we may expect the price of durum wheat in the near future to be as high or higher than that of the ordinary spring or winter wheat.

FACTORS WHICH INFLUENCE QUALITY OF GRAIN.

In studying the influences which affect the quality of grain, one may either grow the same variety of grain in a great many localities, or else grow it in the same locality during a long series of years. In either case we are able to note marked changes in the crop, due to the climatic conditions under which it is grown. As it is only two years since this cooperative work was undertaken, we are limited to a comparison of the same varieties grown in many different localities during this time only. The requirements for growing a plant are many, and the deficiency or excess of any one of them has its influence on the crop. In order to grow, cereals require plant food, water, oxygen, heat, and light. A wheat seed must have an initial temperature of at least 42° F. in order to germinate, and only when the temperature is above that does the plant grow.

Cereals are influenced both in quantity and quality to a greater or less extent by the soil in which they grow, the plant food contained therein, the temperature of the season, the rainfall or the amount of water they receive during the growing period, the amount of sunshine they get, the humidity of the atmosphere, the previous crop, the time of harvest, the length of the growing period, the kind of seed, etc.

In our study of the chemical and physical changes which durum wheat has undergone in growing in different localities or in different seasons, the following determinations have been made: Water, ash, phosphoric acid, nitrogen (gluten), the weight per thousand grains, the weight per bushel, and the character of the grain (whether flinty or mealy). As far as possible the following data were also collected: The monthly temperature and rainfall and the elevation above sea level of each locality, the time of growing and harvesting, the yield, the successive number of crops grown after the introduction of the original seed into this country, and whether or not the crop was grown under irrigation.

The percentage of water in the grain was determined in all cases, that all results might be calculated to a water-free and therefore comparable basis. The ash is of importance in showing the amount of plant food taken up by the plant and transmitted to the grain. The determination of phosphoric acid shows the amount of a most important and too often neglected food constituent, it having been shown that the phosphorus of wheat occurs as an organic compound having a decidedly beneficial effect on nutrition.

The weight per thousand grains is of greater importance than is generally supposed, for when taken into consideration with the weight per bushel it forms the basis of valuation of commercial

wheats; for the heavier the wheat per bushel and per thousand grains, the more protein, as a rule, does the sample contain, and therefore the more nutritious and valuable it is. The weight per thousand grains is also of value in indicating the amount of seed to be sown, as the larger the seed the greater the volume that one should sow.

The nitrogen determination[a] is the most important, as the food and commercial value of cereals depends in a large measure on the amount of gluten they contain. The character of a grain, whether it be flinty or mealy, is likewise a good indication of the nutritive value of a wheat, a more flinty or horny appearance always indicating, in the same variety, a higher amount of gluten. The difference in percentage of protein, as will be seen later, may be as much as 6 per cent in favor of the flinty grain over the mealy one. In many places the price of wheat is dependent mainly upon the gluten content. This is especially true in Budapest, in Magdeburg, and in other markets where buyers depend on weight per bushel and the flinty or amber appearance of the grain, for the more flinty or amber a wheat of the same variety is the higher is the gluten content.

Before discussing the results obtained from the chemical studies and field observations, it may be well to say that of all the samples and varieties investigated three varieties of durum have been selected for comparison—Kubanka, a Russian or northern wheat, and Pelissier and Marouani, Mediterranean wheats, the latter two being from Algeria. These were chosen because they had been grown under a greater diversity of conditions, thus giving better opportunities for more correct interpretation of the influence of the various conditions on the chemical and physical characteristics.

In order to be able to judge correctly of the changes which a plant undergoes in changing its habitat one should know the composition of that plant in its own home. As only a very few of the original samples were available for analysis it was necessary to rely on the published results of wheat analyses for information concerning the character of wheat grown in Russia and other countries. From these sources it appears that Russian spring wheat contains about 3 per cent of nitrogen, an amount slightly greater than that in the average of our American-grown durum wheat, though many individual samples of our durums far surpass that figure. The average per cent of protein in Italian durums is about the same as in those grown under our best conditions. On the other hand, American-grown durums contain several per cent more protein than those grown in Roumania.

The samples of Kubanka were grown in 1903, 1904, and 1905 in every State west of the one hundredth meridian (approximately a straight line drawn through western Dakota to Texas), most of them

[a] Mr. T. C. Trescot, Bureau of Chemistry, made the nitrogen determinations and Mr. Leavitt and Mr. Keister assisted in the analytical work.

coming from the great semiarid region. Some were grown in the irrigated lands of Colorado, Washington, Idaho, and Utah, and some in the dry sections of those States.

EFFECTS OF EXCESSIVE MOISTURE.

In comparing the results the remarkable influence which irrigation or rainfall exerts when either is in excess is very striking. For example, in 1903 eight samples were grown in the arid or semiarid regions and seven samples in more humid localities, as given in the following table:

Comparison of wheats grown in arid and humid regions.

ARID AND SEMIARID REGIONS.

Locality.	Laboratory No.	Nitrogen.	Ash.	Phosphoric acid.	Weight per 1,000 grains.	Weight per bushel.	Flinty grains.	Rainfall.
		Per ct.	*Per ct.*	*Per ct.*	*Grams.*[a]	*Pounds.*	*Per cent.*	*Inches.*
Belt, Mont	1492	2.47	2.03	0.92	30.4	63.7	100	14
Rexburg, Idaho	1481	2.78	1.75	.91	32.9	62.1	95	15
Idalia, Colo	1485	3.16	2.12	1.10	33.8	60.2	100	12
Westport, S. Dak	1479	2.79	2.58	1.04	33.6	60.2	95	27
Brookings, S. Dak	600	2.54	1.69	.83	25.2	....	....	....
Culbertson, Nebr	1493	3.00	2.50	1.18	25.4	58.1	100	20
Heath, Nebr	678	2.72	2.05	.98	26.5	....	100	13
Hays, Kans	1478	2.86	2.48	1.24	24.7	57.1	100	33
Average	....	2.79	2.13	1.03	30.3	....	98	....

HUMID AND IRRIGATED REGIONS.

Locality.	Laboratory No.	Nitrogen.	Ash.	Phosphoric acid.	Weight per 1,000 grains.	Weight per bushel.	Flinty grains.	Rainfall.
Moses, Colo	638	1.43	2.18	0.99	34.1	....	....	(b)
Crestone, Colo	1500	1.84	2.10	1.00	40.0	63.1	20	(b)
Ibapah, Utah	477	2.46	2.68	.99	38.4	....	....	(b)
Bay City, Mich	1489	1.96	2.09	.98	25.3	58.4	85	44
East Peru, Iowa	1491	2.78	2.00	1.03	27.4	61.5	95	36
Fargo, N. Dak	649	2.57	2.14	1.05	34.9	....	....	22
Mayfield, Utah	1,483	2.47	1.85	.88	34.4	60.2	75	(b)
Average	....	2.22	2.15	.98	33.5	....	69	....

[a] One ounce = approximately 28 grams. [b] Crop was irrigated.

The most striking result is the higher nitrogen content of wheat grown in the drier localities, the difference amounting to 0.57 per cent of nitrogen or 3.2 per cent of protein ($N \times 5.7 =$ protein). There happens to be very little difference in per cent of ash or of phosphoric acid, but the weight per thousand grains is considerably higher as a general rule in the more moist regions. A glance at the column headed "Flinty grains" will likewise reveal the fact that in the humid or in the irrigated regions the general tendency of the wheat is to become mealy or starchy. Similar results were obtained in 1905, though owing to the presence of more moisture than usual in the semiarid regions the difference in the nitrogen content is only 0.3 per cent, which is equivalent to 1.7 per cent protein. The weight per thousand grains was as 31.7 is to 35.6, the humid regions producing the larger grains.

In 1904 thirteen samples of Kubanka were grown in as many different places. By separating these into two classes, one consisting of 7 localities with 15 inches or less of rainfall, and the other of 6 localities with more than 15 inches of rainfall or having irrigation, it is again seen that the wheats from the drier regions contain 0.47 per cent more of nitrogen (2.7 per cent of protein). Furthermore, the wheat of the humid regions contains a larger percentage of mealy kernels, showing that there is a very close relation between the percentage of protein and the percentage of flinty grains—that is, generally, the more flinty the kernels the higher is the percentage of protein. An excessive amount of rainfall or irrigation is almost always accompanied by a crop containing a very low percentage of protein. This is further shown in the work done in 14 different localities in the far Western States; 7 of these places were irrigated and the percentage of protein averaged 12.1, while in the 7 places where no irrigation was practiced the protein content of the wheat was 15.4 per cent.

Two samples of durum wheat grown in Mexico were recently received and analyzed. They had been grown from the same seed and on adjacent land. One sample was irrigated, the other was not, there being, moreover, very little rainfall during the growing season. The following table shows the difference in the two samples:

Comparison of irrigated and nonirrigated durum wheats grown in Mexico.

Samples.	Laboratory No.	Protein.	Flinty grains.	Weight of 1,000 grains.
		Per cent.	*Per cent.*	*Grams.*
Original seed	1780	12.3	100	38.8
Irrigated	1781	11.1	20	29.4
Nonirrigated	1782	17.7	100	29.2

The nonirrigated sample consisted of flinty kernels entirely and contained 5.4 per cent more protein than the original seed and 6.6 per cent more protein than the irrigated sample. The irrigated sample contained, moreover, very few flinty kernels (only 20 per cent). The difference in protein content between the irrigated and nonirrigated samples is the greatest that the writer has ever observed, the irrigated sample showing a marked deterioration both in chemical and physical properties.

Such observations on the influence of excessive amounts of moisture corroborate the results obtained by Lawes and Gilbert, in which they showed that the hot, moderately dry seasons produced the best quality of wheat, the cold, rainy seasons yielding the poorest crops in the history of England. The six seasons of bad crops showed rain to have fallen during each of 199 days. The seasons of good crops had but 136 days during which it rained. The probable reason for such differences is that an excessive rainfall dilutes the nitrates

in the soil too much, and there being but small amounts of carbohydrates in the process of formation, owing to lack of sunshine, less protein is formed. The result is a mealy grain of low protein content.

EFFECTS OF PROPER IRRIGATION IN DRY REGIONS.

Without water, however, there can be no vegetable production; even the best soils must lie sterile. When, therefore, there is too little rainfall for plant growth, irrigation is the salvation of the crop. It supplies water when needed, and in proper amounts. It is capable of doubling, even trebling, crops. Backhaus found that irrigation increased wheat straw 94 per cent and wheat grain 169 per cent, the actual value of the increase in crop per acre-foot of water being $27 to $70.

In the mountain States of the West, where irrigation is practiced, in Colorado for example, ideal conditions for plant growth prevail, for there the sky is clear, the sunshine intense, the air dry. Therefore, if water can be supplied when the crops are in need of it, assimilation will go on at its best and the production of organic substance will be all the more favored. The result will be a large crop of large-sized grain. The results, in fact, show this to be true. Whereas the average weight of a thousand grains grown in the semiarid regions from Texas to North Dakota varies from 23 to 31 grams, a thousand grains in the mountain States of Colorado, Wyoming, Idaho, etc., where irrigation is in vogue, average over 36 grams. The table following shows the differences in the same variety of wheat (Kubanka) when grown during three successive seasons with and without irrigation:

Kubanka wheats grown under dry-land farming and under irrigation.

UNDER DRY-LAND FARMING.

Year.	Locality.	Laboratory No.	Nitrogen.	Ash.	Phosphoric acid.	Weight of 1,000 grains.	Weight per bushel.	Flinty grains.
			Per ct.	*Per ct.*	*Per ct.*	*Grams.*[a]	*Pounds.*	*Per ct.*
1903	Idaho	1481	2.78	1.75	0.91	32.9	62.1	95
	Colorado	1485	3.16	2.12	1.10	33.8	60.2	100
	Average		2.97	1.93	1.00	33.3		97
1904	Idaho	1548	2.72	2.05	.98	31.1	57.1	100
	Do	1554	2.60	2.03	1.00	38.4	63.0	95
	Colorado	1562	2.61	2.32	1.21	23.3	61.5	100
	Do	1558	2.64	2.40	1.26	14.5	56.3	100
	Average		2.64	2.20	1.11	26.8		98
1905	Idaho	1555	3.01	1.76	.79	35.0	63.5	100
	Do	1482	3.15	2.08	1.12	27.3	60.9	100
	Colorado	1559	2.41	2.25	1.15	33.6	63.1	95
	Do	1486	2.45	2.16	1.19	33.1	62.1	90
	Average		2.76	2.16	1.06	32.2		96
	Average of all		2.75	2.12	1.07	30.3	60.9	98

[a] One ounce = approximately 28 grams.

Kubanka wheats grown under dry-land farming and under irrigation—Continued.

UNDER IRRIGATION.

Year.	Locality.	Laboratory No.	Nitrogen.	Ash.	Phosphoric acid	Weight of 1,000 grains.	Weight per bushel.	Flinty grains.
			Per ct.	*Per ct.*	*Per ct.*	*Grams.*	*Pounds.*	*Per ct.*
1903	Colorado	638	1.63	2.18	0.99	34.1		
	Do	1560	1.84	2.10	1.00	40.0	63.1	20
	Average		1.74	2.14	1.00	37.1		20
1904	Idaho	1552	2.37	2.22	1.13	39.7	62.8	82
	Do	1549	2.04	2.11	1.06	37.0	62.8	46
	Colorado	1516	1.98	1.90	.97	37.0	63.1	38
	Do	1517	2.02	2.25	1.10	35.8	60.9	47
	Average		2.10	2.12	1.06	37.4		53
1905	Idaho	1553	2.30	2.24	1.13	35.8	62.1	90
	Colorado	1563	1.85	1.97	.89	36.1	64.5	50
	Do	1518	2.11	2.05	1.00	33.7	61.6	70
	Average		2.09	2.08	1.00	35.2		70
	Average of all		2.02	2.11	1.03	36.6	62.7	55

These samples were grown in Colorado and Idaho, some under dry-land farming, the others under irrigation. One of the first differences noted is that under dry-land farming there is 0.73 per cent more nitrogen (or 4.16 per cent more protein) in the dry-land wheat than in that grown under irrigation. The weight per thousand grains, however, is greater under irrigation. The percentage of flinty kernels is markedly greater under dry-land farming. It is almost always the case that irrigation tends to produce a mealy grain, although in several instances it has been noted that even under irrigation the grain has kept its flinty character. This is explainable only on the theory that the irrigation has not been excessive, and suggests a line of research just entered upon—that is, the investigation of the effects of varying amounts of irrigation at different periods of growth. The grain grown under dry-land farming contains practically the same amount of phosphoric acid in the ash as that grown under irrigation, the percentage being 49 in each case.

INFLUENCE OF SOILS, FERTILIZERS, AND TEMPERATURE.

Soils and fertilizers also have more or less influence on the quality of the crop. This influence is much less marked, however, than is that of rainfall or of climate in general. One would naturally expect that soil would exert less influence than the character of the season, from the fact that only 5 per cent of the plant constituents are derived from the soil. Yet it is a well-known fact that nitrogenous fertilizers affect the straw content of cereals, and, to a certain extent, the percentage of protein in the grain, Wiley having long since established that the nitrogen of the grain was present in proportion to the nitrogen of the soil.

Lawes and Gilbert showed that manure performed the function of lessening relatively the transpiration of plants. They established the fact that for every gram of organic matter elaborated 250 to 300 times as much water had been transpired, but that when the land was rich in plant food, after having been well manured, for example, a relatively smaller amount of water was taken up and given off by the plant. Therefore, fertilizers not only supply the plant with the necessary food, but lessen the relative amount of water transpired. It would follow from this that fertilizers are of considerable assistance in combating drought, for we know that potash increases the water-holding capacity of soils, and that one of the chief uses of transpiration is to obtain for the plant the necessary plant food; it is a means rather than an end.

The temperature of the season likewise has its influence on the quality and quantity of plants, hot seasons producing the most abundant crops. As hot seasons are more or less dry seasons also, and wet and cold seasons go together, the latter yielding the poor crops, one must assume that it is not so much a matter of temperature alone as it is of both temperature and moderate rainfall.

ADVANTAGE OF SHORT GROWING SEASON.

The length of the growing period also exerts its influence, the longer period of growth giving, as a rule, a lower percentage of protein. This is conclusively shown in the table following, the crops having been grown without irrigation.

Effect of long and short periods of growth on nitrogen content and weight of wheat.

SHORT AND LONG PERIODS IN THE SAME LOCALITY.

Place	Year.	Laboratory No.	Days.	Nitrogen.	Rainfall.	Weight of 1,000 grains.
				Per cent.	*Inches.*	*Grams.*
Idalia, Colo	1906	1485	111	3.18	12	30.8
Do	1905	1559	157	2.41	20	35.6
Do	1905	1486	153	2.46	20	33.1
Westport, S. Dak	1905	1476	112	2.79	27	33.6
Do	1905	1477	123	2.04	33	34.3
Holyoke, Colo	1902	637	130	2.54	22	35.6
Do	[illegible]	[illegible]	119	3.41	11	33.5

LONG PERIODS OF GROWTH, DIFFERENT LOCALITIES.

Place	Year.	Laboratory No.	Days.	Nitrogen.	Rainfall.	Weight of 1,000 grains.
Tully, Kans	1904	1647	133	2.58	24	35.0
Santa Fe, Kans	1905	1519	152	2.51	19	28.4
McCammon, Idaho	1904	1548	140	2.72	12	31.1
Lansing, Colo	1904	1502	145	[illegible]	21	[illegible]
Idalia, Colo	1905	1559	157	2.41	20	35.6
Do	1905	1486	153	2.46	20	33.1
Blockhouse, Wash	1905	1538	254	1.83	18	34.5
Holyoke, Colo	1902	637	130	2.54	22	35.6
Average			162	2.45	20	31.4

Effect of long and short periods of growth on nitrogen content and weight of wheat—Continued.

SHORT PERIODS OF GROWTH, DIFFERENT LOCALITIES.

Place.	Year.	Laboratory No.	Days.	Nitrogen.	Rainfall.	Weight of 1,000 grains.
				Per cent.	*Inches.*	*Grams.*
North Enid, Okla	1903	1593	71	3.42	29	40.3
Fitzgerald, Okla	1903	659	82	2.62	22	31.6
Oakley, Kans	1904	1649	96	3.05	21	33.2
Fargo, N. Dak	1903	649	99	2.37	22	34.9
Fullerton, N. Dak	1904	1487	86	2.40	21	19.6
Heath, Nebr	1905	1522	102	3.21	24	30.0
Rexburg, Idaho	1903	1481	85	2.78	15	32.9
Idalia, Colo	1904	1558	97	2.64	21	14.5
Cowichi, Wash	1904	1533	73	2.85	10	37.6
Cheney, Wash	1904	1537	70	1.99	14	38.7
Holyoke, Colo	1903	1666	119	3.45	11	33.3
Average			90	2.80	19	31.0

The number of days varies from 71 in Oklahoma to 254 in Washington, where the sample was grown as a winter variety. The difference in the average results between the short and long growing periods is 0.35 per cent nitrogen or 2.1 per cent protein. From the length of the period of growth and the average temperature during that period some conclusions may be drawn as to the number of heat units required to mature a crop in the various localities and under the varying conditions. We find, for instance, that North Enid, Okla., with 71 days as the growing period and 64° as the average temperature of that period, requires 4,544 heat units to mature a wheat crop. On the other hand, Idalia, Colo., required 157 days with an average temperature of 58°, or 9,106 heat units.

Professor Ladd, of North Dakota, found that for conditions prevailing in that State an average of 98.5 days or 6,215 heat units were required for wheat to mature. The results obtained by the writer are very close to these figures, giving an average of 6,280 heat units for North Dakota. For North Dakota, South Dakota, Kansas, and Nebraska, averaged together, 7,037 heat units are required. Practically the same amount, 7,054, is found necessary in Colorado, Montana, Idaho, Utah, and Wyoming. Heat is the chief factor in the distribution of plants, as they only live where the air and soil are warm enough to carry on the vital processes. The absorption of water, and therefore of plant food, by the root hairs, the assimilation of carbon by the chlorophyll of the leaves, stooling, flowering, and maturing all require so many heat units. As a general thing the length of the growing period, and therefore the heat units, decrease as one goes toward the pole; in Norway, for example, barley requires but 1,500 heat units to mature.

INFLUENCE OF SEED AND PREVIOUS CROP.

As to the influence of the seed on the crop, there is here also a diversity of opinion, Fischer, in Germany, maintaining that it has no influence, whereas in the work done by Hopkins, of Illinois, in growing corn for protein or for oil, the seed was selected because of the high protein or oil content.

Considerable work is being done to determine the influence of the previous crop on the quality of grain, such work being carried on in cooperation with the experiment stations of Tennessee and California. As the fertilizers exert more or less influence it is to be expected that such crops as legumes will play some part in modifying the composition of wheat.

EFFECT OF TIME AND MANNER OF HARVESTING.

The time of harvest also affects the quality of a grain to a marked degree. If harvested too early, the grain is shriveled and so of inferior quality; if harvested too late, the quantity only is appreciably affected, as a considerable loss is apt to take place through shattering. The most propitious time for harvesting is when the grain is of a waxy consistency and can be cleanly broken by the finger nail. From this time on there is no appreciable change in the chemical composition of the dry matter. Any delay in harvesting after the waxy consistency of the grain makes its appearance may result in considerable loss, not only through shattering, but from the effect of unfavorable weather conditions. Even during the time of the Romans the saying was "Better to harvest two days ahead than two days too late."

The changes which take place during the growing period are of exceeding interest. Up to the time of full flowering, wheat has elaborated 87 per cent of the dry matter and has absorbed all the nitrogen, lime, and potash that it requires and 74 per cent of the phosphoric acid. From this it will be seen that the plant continues to absorb phosphoric acid from the soil until almost mature. Shortly before maturity the mother plant ceases to draw any further nourishment from the soil, and it then becomes the function of the plant to transport the elaborated materials to the head and grain. At this time a severe drought, accompanied by excessively hot weather, is apt to check the process of transporting the soluble substances elaborated in the leaves and stems to the head and grain, thus causing the production of a shriveled wheat.

In 1905 the writer collected several samples of wheat at Brookings, S. Dak., some of which were harvested early, i. e., in the soft dough stage, and some after fully maturing. In every case those samples harvested early gave a very low weight per thousand grains and were more or less shrunken. Those harvested late were plump. The following table shows the results more in detail, giving the per-

centage of nitrogen, the weight per thousand grains, and the percentage of flinty kernels. Enough samples were harvested so that part of each one could be allowed to ripen in a protected place (indoors) and part outdoors or exposed. In every case also part of the sample was harvested with the stems, that is, the whole plant was harvested, and of part only the heads were collected.

Comparison of wheats harvested early and late and under other varying conditions.

WHOLE PLANTS HARVESTED

Laboratory No.	Tested for—	Harvested early.		Harvested late.	
		Protected after harvest.	Exposed after harvest.	Protected after harvest.	Exposed after harvest.
8230	Nitrogen ... per cent	2.02	2.01	1.99	1.99
	Weight of 1,000 grains ... grams	29.94	26.84	37.68	36.48
	Flinty grains ... per cent	95.00	80.00	95.00	90.00
8212	Nitrogen ... per cent	2.01	1.88	1.80	1.89
	Weight of 1,000 grains ... grams	30.16	30.74	33.78	34.24
	Flinty grains ... per cent	95.00	85.00	95.00	90.00
8213	Nitrogen ... per cent	1.91	1.93	2.04	1.97
	Weight of 1,000 grains ... grams	29.10	28.50	35.64	36.16
	Flinty grains ... per cent	95.00	90.00	90.00	95.00
5643	Nitrogen ... per cent	2.14	2.08	2.11	2.09
	Weight of 1,000 grains ... grams	26.50	24.00	35.98	33.86
	Flinty grains ... per cent	98.00	90.00	95.00	95.00
Average	Nitrogen ... per cent	2.02	1.98	1.99	1.99
	Weight of 1,000 grains ... grams	28.92	27.52	35.77	35.19
	Flinty grains ... per cent	96.00	86.00	94.00	93.00

HEADS ONLY HARVESTED.

Laboratory No.	Tested for—	Harvested early: Protected after harvest.	Harvested early: Exposed after harvest.	Harvested late: Protected after harvest.	Harvested late: Exposed after harvest.
8230	Nitrogen ... per cent	2.15	2.17	1.94	1.92
	Weight of 1,000 grains ... grams	23.94	23.20	37.08	36.48
	Flinty grains ... per cent	100.00	90.00	85.00	90.00
8212	Nitrogen ... per cent	1.90	1.99	1.92	1.91
	Weight of 1,000 grains ... grams	30.90	27.78	35.64	34.66
	Flinty grains ... per cent	95.00	90.00	95.00	95.00
8213	Nitrogen ... per cent	1.96	1.93	2.01	1.91
	Weight of 1,000 grains ... grams	25.80	27.30	34.64	35.42
	Flinty grains ... per cent	90.00	85.00	90.00	90.00
5643	Nitrogen ... per cent	2.09	2.02	2.14	2.10
	Weight of 1,000 grains ... grams	24.56	25.64	36.94	35.90
	Flinty grains ... per cent	95.00	85.00	95.00	100.00
Average	Nitrogen ... per cent	2.03	2.03	2.00	1.96
	Weight of 1,000 grains ... grams	26.30	25.90	36.07	35.61
	Flinty grains ... per cent	95.00	88.00	91.00	94.00

The table shows that when only the heads are harvested early the grain thereon is small and shriveled, whereas if harvested late the grain is plump. The reason for this is that the heads harvested early being cut off from the stems, the supply of elaborated food in the latter is actually lost to the grain. The grain, therefore, is unable to increase in weight. On the other hand, the heads which had ripened on the stem, that is, those harvested late, had received from the latter much of the elaborated material. The difference in the number of flinty kernels in the grain harvested early and late when the samples were protected is too small to afford any conclusions; but when the

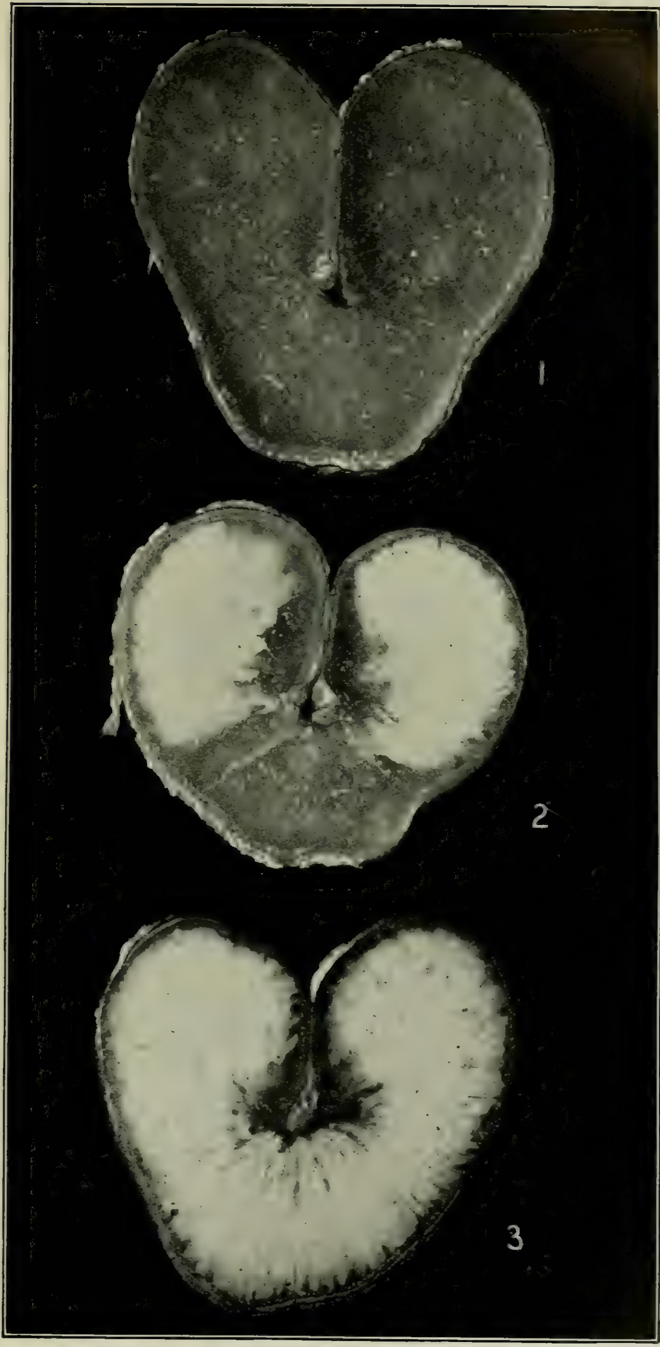
samples were exposed, the one harvested early had a smaller number of flinty kernels. This was true likewise of the samples harvested on the stems; the one which was harvested early and exposed contained a smaller amount of flinty grains than the one collected at full maturity. This was due to the effect of weathering, as it is well known that intermittent rains have an injurious effect on the grain in the shock, much more so than when the grain is still standing. The grain which was harvested late was not materially affected, so far as its flinty character is concerned, by exposure, whether the heads only or the whole plants were collected. Likewise there is little difference in the weight per thousand or the percentage of nitrogen, showing that at full maturity no more change goes on in the plant.

This table also shows that the percentage of nitrogen or protein is practically the same in every sample whether harvested early or late, heads separate or the whole plant, and whether these samples were protected or exposed. The chief difference here is the the weight per thousand, the samples harvested late weighing 7 to 10 grams more than the early ones. This simply means that on ripening the elaborated organic material in the leaves, stems, and heads is transported to the grain and that this material is also rich in proteid substances. The number of starchy grains, that is, those having white spots, is not very great in any case, as is shown by the percentage of flinty kernels. The samples harvested early and exposed have the greatest number of starchy grains.

From the table on page 209 it will be clearly seen that the samples of heads only, which are harvested early, yield a grain which is appreciably smaller than when the whole plant is harvested early. The same explanation here holds true as was made above when considering early and late harvesting of heads only, but to a less degree. In this case only a comparatively small part of the elaborated material is transported from the stem to the grain, giving it a higher weight per thousand, that is, the weight per thousand grains where the heads only were harvested early is 26.3 grams, whereas when the whole plant is harvested at the same time the weight per thousand has increased to 28.9 grams. Such experiments clearly show that harvesting by means of "headers" should be carried on only when the grain is fully mature, as otherwise an incompletely developed or shriveled grain will be obtained.

VALUE OF DURUM WHEAT.

Professor Shepard, of South Dakota, has recently issued a report on durum wheat, in which it is shown that Kubanka contains less bran than Red Fife, that more flour is made from Kubanka, and that the flour contains a larger amount of the proteid of the wheat than does flour made from northern spring wheat. Baking tests, however, show



PHOTOMICROGRAPHS OF CROSS SECTIONS OF WHEAT GROWN UNDER VARYING CONDITIONS.

[1.—Flinty wheat grain grown under dry farming. 2.—Half-starchy wheat grain. 3.—Starchy wheat grain grown under excessive irrigation.]

WHOLE WHEAT SHOWING (1) FLINTY, (2) HALF STARCHY, AND (3) STARCHY GRAINS. (X4½.)

that spring wheat makes a larger loaf and contains a larger amount of gliadin in the gluten than is the case with Kubanka wheat. Taking it all in all, however, Professor Shepard states that "for the yield, hardiness, flour yield, protein distribution, and the quality of both bread and macaroni, durum wheat, especially Kubanka, is to be recommended for general use."

Several years ago Clifford Richardson, of the Bureau of Chemistry, published the results of several hundred analyses of wheat grown in the various States of the Union, from which it appears that the average protein content of our American spring and winter wheat (*Triticum vulgare*) is 12.2 per cent, whereas the average proteid content of considerably over one hundred samples of durum analyzed by the writer is 14.7, or 2.5 per cent more than that of the common wheat.

Durum wheat grown in Algeria contains only from 8 to 10 per cent of water. Common wheat grown in countries adapted thereto contains from 10 to 16 per cent of water, according to the moisture of the atmosphere. The difference in the water content was sufficient to make the French officials investigate the advisability of buying wheat from dry-land regions, which wheats would contain less moisture, and thus not only a large saving would be made in the cost of transportation, but more wheat per bushel would be actually obtained.

IRRIGATION EXPERIMENTS.

As climate is the great factor in influencing the composition of crops, and as we are powerless to change it in any way, it devolves upon us to make as wise a selection of our grains as possible, choosing those which are more apt to resist the unfavorable elements. Though we can not control rainfall, we are able in irrigated districts to determine how much water a crop shall receive by irrigation. As excessive irrigation tends to change the hard, flinty durum into a soft, mealy grain, thus robbing it of its most important physical characteristic, as well as lowering its nitrogen content below that of a true durum, it is important to carefully determine the amounts of water that should be given to a wheat crop and the times during the period of growth when it should be applied. This question is the subject of an investigation which is being conducted in cooperation with several of the Western States where irrigation is practiced and facilities exist for irrigating with definite amounts of water at stated periods.

ILLUSTRATIONS OF OVER-IRRIGATED GRAINS.

The photomicrographs shown in Plate X represent cross sections of grain grown under dry-land farming and under irrigation. Figure 1 represents a durum grown on land not irrigated, being flinty, hard, and translucent, and containing over 18 per cent of protein. No. 2 is an

intermediate grain, showing both the starchy and the flinty characteristics. No. 3 represents a grain from the same kind of seed as that which produced No. 1 and grown on adjacent land, but under excessive irrigation, the result being a soft, mealy, dull-looking grain, somewhat shorter than No. 1 and containing only 12 per cent of protein. It has lost its durum characteristics entirely, and is no more suitable for making good macaroni than are our soft wheats. Plate XI is a reproduction of an enlarged photograph of the whole wheat grains, and represents the same samples as are shown in Plate X, No. 1 showing the dark amber color of the flinty grain, No. 2 the intermediate sample, and No. 3 the light starchy grain. Both the photomicrographs and the photographs shown in these plates were made by Burton J. Howard, chief of the microchemical laboratory of the Bureau of Chemistry.

NECESSITY OF PRODUCING HIGH-PROTEIN WHEATS.

In conclusion, it may be well to emphasize the fact that the countries which are the great buyers of wheat purchase generally on the basis of protein content, that is, on the basis of the weight per bushel and the weight per thousand grains, while in some localities wheats are bought on the basis of the chemical analysis itself. It is therefore of the utmost importance, in order to retain our foreign markets and maintain our commercial supremacy and national reputation as producers of high-grade wheat, that the closest attention be paid not only to the production of high-yielding wheats but also to the cultivation of varieties having a high protein content, with a view to growing wheats which combine these two characteristics—high gluten content and large yields.

THE GAME WARDEN OF TO-DAY.

By R. W. Williams, Jr.,
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INTRODUCTION.

For several hundred years the enforcement of criminal laws of all kinds in this country has been intrusted to sheriffs, constables, and police officers, and until the middle of the nineteenth century this method was considered satisfactory. But with the growing demand for more stringent enactments for the preservation of game and the increasing complexity of statutes for this purpose it was found no longer practicable to include the burden of enforcing them among the duties devolving upon general officers, and their enforcement has consequently been intrusted to special officials, usually called game wardens.

The origin of the term "warden" in relation to game is somewhat obscure, but it was probably adopted in analogy to church and wood wardens in England, where the word first came into use. However this may be, a game warden is now generally understood to be an officer charged with the enforcement of laws for the protection of game and fish. Several substitutes for the term are in use in a few States and Canadian Provinces. Thus in New York all, and in New Jersey and Pennsylvania some, game officers are styled "protectors;" in New Hampshire the designation "detectives" is employed; in Prince Edward Island, "inspectors," and in Alberta, Manitoba, and Saskatchewan, "game guardians."

Wardenships for the protection of fish existed quite early in the history of this country, and some time after the establishment of similar offices for the protection of game the duties of the two were united and intrusted to the same officers. Consequently to-day, in all but a few States, the game warden is a fish warden also and performs manifold duties in that capacity. The present article does not deal with this phase of his duties, but is limited in scope to those he performs solely as a game warden.

In the United States the establishment of a special office for the protection of game and the enforcement of the game laws dates back to 1852, when the legislature of Maine created the office of moose

warden, directed the governor to appoint one for each of the counties of Oxford, Franklin, Somerset, Penobscot, Piscataquis, Aroostook, and Washington, and allowed the warden three-fourths of the fines recovered for killing moose and deer contrary to law. This seems to be the first game wardenship established in this country. For three decades there was very little further activity in this direction. A few States authorized the appointment of local wardens, but the experiment was almost entirely a failure. During the period between 1878 and 1888, however, the urgent necessity for enforcement of game laws became apparent, and in that decade ten States created a State office or department charged with the enforcement of the game laws. Other States quickly followed, and at the present time in thirty-six States and Territories the enforcement of the game laws is intrusted to a State board, a warden, or, as in North Carolina and Delaware, to an incorporated association. Florida, Georgia, Kentucky, Louisiana, Nevada, and South Dakota still adhere to the county warden system, and Texas, Alabama, and Arkansas provide no special officer for protection of game. Correlated with the establishment of these offices has been the increasing complexity of game laws, until at the present time the modern game statute assumes the magnitude of a criminal code, and to enforce its provisions and exercise the powers thereunder requires a high degree of judgment and skill. The necessary qualifications of an officer in this department of the State's service are consequently much greater to-day than formerly. This is apparent from an examination of the one hundred and fifty-six sections of the Colorado game law, which, it may be noted, do not include the provisions relating to nongame birds.

THE OFFICE OF GAME WARDEN.

Since the establishment of State offices or departments for the protection of game, the position of warden, whether the jurisdiction extends over the entire State or is confined to a small area, has assumed an importance and dignity it did not formerly possess. Fortified by plenary power to enforce the game laws, and with a consciousness of the important public service performed, the warden of to-day stands upon an equal footing with other executive officers of the Government, and commands like respect. The salary attached to the position of State commissioner or warden in those States providing for a salary compares favorably with the compensation of other State officials. In New York it is $5,000 a year, in Illinois $2,500, and in other States it varies from $1,000 to $2,000. In the States which intrust the administration of the game laws to a board of commissioners, position on the board, except in Connecticut, Massachusetts, and Maine, is honorary and without compensation. Such is the case in Arizona, California, New Hampshire, New Jersey,

Minnesota, Ohio, Pennsylvania, and Rhode Island, but even under these circumstances the States have no difficulty in securing ready and capable men.

The compensation of deputies varies more than that of the State officers, and the system of payment adopted by each State has features distinct from those of any other. A few States pay their deputies salaries. In Montana each of the eight district wardens receives a salary of $100 a month, and in California the salary of county warden is graduated according to the population of the county, $50 to $125 per month, with an additional allowance of $25 for expenses. Colorado allows each of her five chief wardens $900 a year and $300 for expenses, besides a share of fines and officer's costs. In Illinois the ten district game wardens receive $900 a year each and their actual and necessary expenses while under the direction of the commissioner. Game protectors in New York, except the chief, first, second, and third assistant protectors, who receive annual salaries of $5,000, $2,000, $1,400, and $1,200, respectively, are paid $600 a year, and receive one-half of the fines in actions brought upon information furnished by them; and they are allowed also $450 a year for their expenses. In some States the deputies receive the whole or part of the fines, together with the usual fees of a sheriff or constable. In Tennessee the State warden serves without compensation.

The terms of service are usually the same as those of other officers. The State warden of Tennessee, however, is appointed for eight years, a longer term than is usual for any State officer.

It may be of interest to note, as showing the type of men required for this work, that the present warden of Tennessee was a former member of the Federal House of Representatives; that one of the Members of Congress from Michigan was the first warden of that State; that the present game commissioner of one of the States was formerly United States minister to Turkey; and that several prominent lawyers and physicians are serving their States in the capacity of State warden or as members of boards of game and fish commissioners. The governor of Nebraska is nominally fish and game commissioner of that State, but the active work of the office devolves upon his chief deputy. This somewhat anomalous condition is due to a constitutional prohibition against the creation of any executive State office not provided for in the constitution. Hence the law of 1901 establishing the office of game and fish commissioner provided that the duties of the position should devolve upon the governor.

DUTIES.

The duties of a game warden are those usually performed by a sheriff, but they differ in one important particular, and this difference inheres in the object for which the wardenship was established.

A sheriff ordinarily acts only in pursuance of preliminary proceedings by private persons or by a court officer and usually under a warrant issued by a court commanding him to arrest a certain person, summon a jury, or perform similar acts; but a warden can not await the initiative or detection of a violation by others. He must act, must himself search out violations, find the evidence wherewith to convict offenders, and institute prosecutions. This is one of the primary reasons for the existence of a special officer to enforce the game laws.

During the open season much of the game warden's time is spent in examining shipments, and if his territory includes a railway center this service is arduous and requires much night work. The devices employed by shippers to conceal contraband trade in game compel wardens to examine many packages the contents of which are not exposed to view. It frequently happens that the warden must perform detective duty in order to secure the evidence necessary to convict suspected parties, and this means that occasionally he is subjected to all the dangers of such service. In States prohibiting sale or possession of game he must periodically visit and inspect hotels, restaurants, and other resorts where it is likely to be served to guests, and must keep a watchful eye on markets and cold-storage plants. In a few States and in several of the Canadian Provinces wardens issue hunting licenses, and in consequence are compelled to keep accounts. By the passage of laws in several States prohibiting the hounding of deer and directing the wardens to kill dogs found chasing or molesting deer or found in the deer country, another task, and often a disagreeable one, is added to the warden's duty. The secretary of the game commission of Pennsylvania, in January, 1906, estimated that 1,500 dogs had been killed in that State during the few months of the operation of the law. Examination of hunting licenses issued to nonresidents requires the warden's attention, and it is always necessary for him to make sure that all persons found hunting are provided with proper licenses. In many States wardens are required to destroy traps and devices employed to capture game, and in a few to seize guns and shooting paraphernalia used in violation of law. They often perform the duties of auctioneers in the sale of confiscated game, guns, traps, nets, etc. Occasionally when an offender against the game laws has escaped into another State the warden is required to enter that State and, with proper requisition papers, apprehend and bring back the fugitive. In nearly every State wardens are empowered to serve criminal and civil process just as a sheriff would, and this requires knowledge of the proper procedure.

Every statute providing for the appointment of a warden defines his duties, some more explicitly and in greater detail than others;

but the officer who would perform the greatest service to the State must do many things not laid down in the law. As a rule, the active field work of the game department is performed by deputies under instructions from the State warden, but the laws of Idaho and Wyoming declare that the State warden shall be an active executive officer, and when possible shall take the field in person in performance of his duties.

An officer who realizes the responsibility of his position can do much to bring game protection into popular favor. He may easily become an educator, however circumscribed his field. Much of the wanton destruction of animal life proceeds from thoughtlessness, and few persons once impressed with the importance of preserving wild creatures continue to destroy them. In North Carolina the bird and game wardens, in addition to their official duties, spend a considerable portion of their time educating the public as to the value of birds and game to the State. During the close seasons they visit farmers, explain and discuss the game laws and their object, and hear complaints. Each warden is supplied with a selection of standard books on birds and is required to familiarize himself with them, so as to be able to answer the numerous questions propounded.

A very useful and interesting feature of a warden's duties in Illinois is the periodical census made by him of certain species of game. In this way the commissioner, with reasonable accuracy, can determine the status of certain species and recommend necessary legislation. Similar service is performed by the wardens in Pennsylvania. The general adoption of this scheme over the entire country would greatly facilitate the drafting of proper laws and in addition furnish very interesting statistics.

Another valuable service performed by the Illinois wardens consists in rendering aid to the farmers in enforcing the trespass laws. Telephone connection makes it possible to quickly reach the scene of a trespass, and ready response has greatly reduced the number of such offenses in that State. The Illinois and Wisconsin wardens, as part of their duties, periodically examine and check up the hunting-license accounts of the county clerks.

The rapid decrease in the number of quail in several States, due to starvation in severe winters with heavy snows, has awakened the citizens of those States to a realization of the necessity of providing food for the starving birds during such periods. The game departments in some of the States have adopted a systematic plan for purchasing and distributing this food by the aid of wardens. During the winter of 1904–5, which was very severe and protracted as far south as North Carolina, thirty wardens in that State devoted much of their time to distributing grain for the quail and in enlisting the cooperation of the farmers in their behalf. During the same winter

some of the wardens of New Jersey purchased grain at their own expense and distributed it widely in their territory, and the Indiana wardens employed men with sleighs to distribute food for the quail. In Illinois quail were systematically fed by the game department during that winter. An expenditure of $25 in each county was authorized by the State game commissioner to be used in February, and with the means thus supplied the wardens were able to scatter a large amount of grain throughout the region inhabited by quail. The mounted police on duty in the neighborhood of Washington, in the District of Columbia, under instructions from their superintendent, who is ex-officio game warden of the District, carry with them regularly, during severe weather, bags of grain from which they scatter food for the quail.

POWERS.

The powers exercised by the wardens of the present day are very extensive. Indeed, were it not so, enforcement of game laws and the consequent preservation of game would be impossible. It is the exception now for a State to withhold from its game wardens the right to arrest without warrant persons found in the act of violating the law, and a number of States confer upon their wardens the right to search summarily any place where they suspect contraband game to be concealed. In New York the power of search without warrant under the game laws is granted to game protectors, but is withheld from peace officers, who otherwise exercise all the powers of protectors in the enforcement of the game laws. Several States have excepted dwellings from the general warrant of search, thus preserving the ancient and time-honored sanctity of the home. While the warden may be lawfully invested with broad powers, it behooves him to use tact and discretion in exercising them, so as to give no just grounds for complaints of oppression.

In Michigan and Wisconsin wardens are authorized to conduct prosecutions in the courts in the same manner and with the same authority as prosecuting attorneys, and in Oklahoma and West Virginia they may do so without the sanction of the prosecuting attorney. In Tennessee the State warden may compromise or discontinue cases where the violations are technical or where he believes the prosecution or fine would be oppressive. In Maine the commissioners of inland fisheries and game may entirely prohibit the taking of any kind of game in any part of the State for a series of years, not exceeding four. These are some of the extensive powers granted wardens, and they illustrate the position of the service at the present day. In this connection may well be quoted the instructions given the deputy and county wardens of Michigan by the game warden of that State:

> The proper observance of the fish and game laws depends almost entirely upon the vigilance and good judgment of the county and deputy wardens. Keep your eyes and ears open for violations, but do not be too hasty in acting upon what you hear. Be

careful not to let the public know your plans. Be vigilant and fearless in enforcing the laws, but try to do so without being obnoxious. Be gentlemanly at all times. Show no favoritism, and be especially careful that all persons are treated alike. It is important that the people should be awakened to the importance of respecting the laws for the preservation of fish and game. Use your influence to arouse public sentiment in this respect. (Game Warden Dept. of Mich.—Instructions to Wardens, 1903.)

SPECIAL EQUIPMENT.

The equipment of the game warden differs very little from that of other officers who enforce criminal statutes, but on account of the character of the territory to be patrolled several States in the past few years have provided launches for wardens doing duty on water courses. Massachusetts for several years has kept in service along the coast a naphtha launch, the efficiency of which the commissioners of that State declare to be equal to that of a hundred men. The Audubon Society of North Carolina, an incorporated body, which, under the terms of its charter, administers the game laws in that State, maintains a launch for the use of its wardens along the Atlantic coast. This boat is used in winter for patrolling the ducking grounds in the larger inlets along the coast of North Carolina, where wild fowl resort in great numbers and are extensively shot for market; and in summer it does duty in the region about Cape Hatteras and Ocracoke Inlet and around the islands in Pamlico Sound, where large numbers of sea birds rear their young. The game commissioner of Illinois has recently provided a cabin cruising launch for the use of the wardens along the Illinois River, and early in 1906 New York authorized the purchase of a steam or electric launch for the use of the two game protectors on Jamaica Bay and adjacent waters, and appropriated $1,500 for the purpose.

The police department of the District of Columbia maintains a launch for service on the Potomac River largely to enforce the game laws on the marshes along the river.

The National Association of Audubon Societies, always desirous to cooperate with game wardens, owns a launch with which its warden patrols the southern coast of Florida in the interests of the nongame birds of that State; and in Louisiana its warden, who has supervision of the Breton Island Reservation in the Gulf of Mexico, is the owner and captain of a schooner which he uses in his work of protection.

CIVIL-SERVICE SYSTEM FOR GAME WARDENS.

With increasing necessity for enforcement of the game laws and the corresponding intricacy of these laws arises increased necessity for more intelligent officers to execute them. The civil-service rules, which have worked so well in other departments of the State government, have recently been applied to the game departments of Massachusetts and Wisconsin, and their example will, without doubt, soon

be followed by other States. The system, besides insuring a higher grade of officers, has the advantage also of eliminating politics from the service. An examination of the questions propounded to candidates for the position of game warden in Wisconsin shows that in that State great importance is attached to ability to endure exposure and hard physical exertion. Some account is taken of the applicant's familiarity with the game laws and conditions in his territory, and enough arithmetic is required to test his ability to keep his accounts. On the other hand, in Massachusetts less importance is attached to physical endurance, but applicants for the position of deputy fish and game commissioner are required to answer exhaustive questions on their powers and jurisdiction under the game laws, and in relation to the preliminary procedure in the courts.

Applicants should be examined upon the subjects usually included in the common-school course. Physical fitness and such previous experience as would be serviceable in the position sought should have due weight. Other qualifications being equal, the applicant who is an experienced hunter should command precedence over one who is not.

In order to secure the largest measure of efficiency in the game department, civil-service questions should be framed to test the applicant's qualifications to perform any and all services likely to devolve upon him in the performance of his duties. They should elicit his knowledge of the powers, duties, and jurisdiction appertaining to the position of warden and the methods of procedure in case of violation of the game laws. He should have a general knowledge of the object of game laws, and should show fair acquaintance with the fauna of his territory, especially with the species classed as game; he should be familiar with the limit of hunting seasons, with prohibited devices and methods, limitations on amount of game permitted to be killed, and restrictions on hunting by residents and nonresidents, and on sale and transportation. If the examination is for one of the higher positions in the service, such as chief warden, the applicant should know something of the decisions of the higher courts in cases involving game, at least in his own State.

ASSOCIATIONS OF WARDENS.

In the early part of December, 1892, the fish and game wardens of the two Dakotas, Minnesota, Wisconsin, Iowa, and Illinois met in convention at St. Paul, Minn., for the purpose of considering a uniform game law for the States mentioned. A bill providing for such a law was agreed upon, but failed of adoption in the several States. Since this meeting similar conventions have been held in other sections of the country, with like objects in view, but no permanent association was organized until July 21, 1902, when the State wardens

and commissioners of Colorado, Minnesota, Montana, Oregon, Utah, and Wyoming, together with several other persons interested in game protection, met at Mammoth Hot Springs in the Yellowstone National Park, pursuant to previous agreement. A permanent organization was effected under the name of the National Association of Game and Fish Wardens and Commissioners. Papers were read and discussed on various phases of game protection, spring shooting, hunting licenses, export and sale, bag limits, and the right of search. The primary object of the association was to secure cooperation between the States. The constitution adopted made all State and Federal game officials eligible to membership, and fixed the entrance fee at $10. The discussions at this meeting had a marked effect upon subsequent legislation and have resulted in more stringent enforcement of the game laws. This association was reorganized on February 11, 1904, and, with dues reduced to $5, now numbers among its members the State game officials of most of the States where such office exists.

A personal acquaintance with the deputy and county wardens in the State is always of great advantage to the State officer in the administration of his duties, and in recent years several officials have called conventions of their deputies for this end and to discuss matters pertaining to their duties. One of the first meetings of this character of which the writer has any knowledge occurred in Montana in 1901, shortly after the creation of the offices of State and district game wardens, when, in compliance with the summons of the State game and fish warden, the eight deputies met at his office in Helena for the purpose of mutual acquaintance and instruction by him in the duties of their position.

Quite the most notable and successful of these conventions met in the Armory Building at Springfield, Ill., on January 26, 1904, pursuant to a call issued by the game and fish commissioner of that State. There were seventy-five wardens present, and after organization the commissioner stated that the object of the meeting was to become acquainted, discuss matters of general interest in game protection, study carefully the new game law in order that all might understand its provisions, and outline a general policy for its enforcement. Some very interesting and important papers touching various phases of bird and game protection were read and discussed, and new legislation was proposed, some of which was enacted at the following session of the legislature. (A detailed account of this meeting will be found in American Field, vol. 61, p. 119.)

One of the most recent meetings was that of the game protectors of New York, who met in Albany during February, 1906, and formed a permanent organization. Hereafter they will meet yearly for the purpose of discussing matters pertaining to their duties.

PERILS OF THE WARDEN'S POSITION.

The record of fatalities incident to the warden's official life testifies to the perils of the position. Exposure to inclement weather, with attending discomforts, may be reasonably accounted part of the chances a warden assumes when he enters upon the duties of the office; but conditions should not be such as to compel the risk of surrendering his life to the depravity of his fellow-men. Yet such is the fact. Several deputies and other officials have been killed within recent years while in the discharge of their duties. In not a few cases the culprits have received merited punishment for their crimes and have been sentenced to prison for longer or shorter periods. In other instances they have gone unpunished, as in the case of a plume hunter who killed a Florida warden while he was attempting to arrest him for shooting herons in a colony of nesting birds and who escaped through refusal of the grand jury to indict him. In cases of miscarriages of justice like this, however, it should be remembered that game laws and game wardens are of comparatively recent origin in the United States, and that only a short time ago the popular idea respecting fish and game was that wherever found they were almost as much the property of the individual citizen as the air we breathe. The creation of a healthy public sentiment everywhere in regard to the protection of game and the enforcement of game laws is only a matter of time, and the wonder is, not that violations of the law, followed by occasional tragedies, occur in remote districts, but that respect for the law is so widespread, cooperation so general, and the cause of bird and game protection so far advanced in public estimation in so short a time.

The most serious problem the warden of to-day has to contend with in some sections of the country is the control of certain classes of immigrants who in increasing numbers infest the woods and fields of some of our Northern States at all seasons intent upon the slaughter of all kinds of birds. They set at defiance the game and trespass laws, and to warnings not to hunt upon the farmer's land they sometimes respond with the use of weapons, occasionally with fatal results. The seriousness of the situation is echoed in the following paragraph from the report of the board of game commissioners of Pennsylvania for 1904, page 3:

> We are deeply impressed with the grave condition that surrounds the enforcement of our game laws in communities where the foreign element * * * is in any force, and recognize in this question the most serious one we are compelled to meet. This class seems possessed with the same purpose throughout the State, and is the most persistent and determined in not only violating the law, but in resisting arrest and attempting to evade punishment after they have been arrested. Hardly a week passes without an assault of some kind upon our officers from these people.

REVENUE FOR THE WARDEN SERVICE.

The long delay in establishing a practical and efficient scheme for enforcing game laws in the United States was due more to lack of financial means than any other one cause. Only a small part of the people in each locality hunted, and the suggestion to levy a special tax or to appropriate funds from the general treasury for the support of a wardenship excited strong opposition. It was argued that citizens who, from lack of inclination or convenience, do not hunt should not be taxed for the maintenance of the sport. So strong was this sentiment that advocates of game preservation undertook to find a way by which the laws could be so framed as to provide funds for their own enforcement. A provision was inserted in the game laws providing that the informer should be entitled to a moiety of the fine or that the game warden should receive the whole of it. But competent men were not readily found to work for such uncertain and inadequate compensation and the game laws were not enforced in many localities. Finally, within the last twelve years the hunting-license system as a means of raising revenue for game protection has proved to be more successful and more equitable than any other, since those who hunt and are directly benefited by the enforcement of game laws contribute the funds for the protection of game. Since the inauguration of this method nearly every State has established a game department, and several of them support their departments wholly from hunting-license fees.

At first the nonresident was the only one required to take out a license to hunt, and this is now the usual license issued; but it was found that public sentiment in several States favored a small fee for residents and in 16 States this additional fee is now required. In Illinois the fund derived from this source is so large (the receipts in 1905 amounting to $127,988) that after payment of all salaries and other expenses of administration a large surplus remains, which the legislature has authorized the State game commissioner to use for the purchase and propagation of quail, prairie chickens, and pheasants. The commissioner has established a game farm near Springfield and has stocked it with several species of game birds, foreign and native. This project has met with marked success and bids fair to furnish the State with game to stock depleted covers. Thus the license system, originally adopted merely for the purpose of supporting the warden service, has very materially broadened the scope of the State game department.

CONCLUSION.

It will be seen from the foregoing that game wardenship in this country has reached its present state of efficiency within a comparatively short time. Beginning with the very local moose wardenship

in Maine in 1852, the service has been gradually extended in scope and purpose until now there is scarcely a locality in the United States where a game warden is not in service—scarcely a wild bird or animal which does not come under his protection.

This satisfactory condition has not been attained without a struggle. Many obstacles have been placed in the way of progress by an unwilling, because uninstructed, public, and these have been overcome only by the persistence and devotion to duty of those who have occupied the office during the formative period. The game warden of to-day should recognize this obligation to his predecessors and endeavor not only to maintain but to surpass the high standard established by them.

Some of the former antagonism against game laws still persists, and in certain parts of the country the wardenship is yet in an experimental stage; but it may be safely predicted that in the near future every State in the Union will have established its game department on a footing with its other executive offices. In spite of its growing importance and power, however, the office of game warden is a difficult one to fill, and it is the duty of every good citizen to lend this important public servant every assistance and encouragement in the discharge of his duties.

RANGE MANAGEMENT.

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THE PRESENT SITUATION.

At the present time the greater part of western grazing lands is badly overstocked. Some of the ranges are so crowded that the stockmen are experiencing difficulty in getting sufficient grazing for their herds. Many herds have been cut down in order to meet these conditions, while in some instances, rather than run the risk of an unusually hard winter or a period of drought, stockmen are going out of business entirely.

When the first stockmen drove their herds on the western range lands there was a great abundance of feed, and it was generally believed that this feed would never be fully utilized. As a consequence these men increased their herds as much as possible, so as to use all of the feed they could. Others, seeing the prosperous condition of these men, began to bring in large herds, that they also might get their share of the free grass. Thus it was only a few years until the range was carrying more stock than it could properly support.

During the past few years there has been a heavy immigration of settlers to several parts of these grazing lands. These settlers have taken up large bodies of the very best grazing lands for farming purposes. The men ranging their stock in these areas were for the most part crowded back to the ranges of other stockmen, thus greatly aggravating the already crowded condition of the range. As a necessary result of all this overcrowding the range began to deteriorate.

The rate of this deterioration has been governed somewhat by accessibility, a range that is easily accessible being much more likely to be overstocked than one that is difficult to reach. It has, however, been governed much more largely by climatic conditions. In the northern range States, where the severe winters and the liability of a heavy fall of snow acted as a check, and where the rainfall is sufficient for the growth of a good crop of grass, the deterioration of the range has been rather slow until the past few years. In the South, where the stock can be grazed the year round with perfect safety, the range has been stocked to the highest number it would

carry during favorable seasons. When a period of drought has occurred, with a consequent shortage of grasses and other forage plants, the same number of animals has been still on hand to be supported. This has resulted in severe grazing of the native grasses and other forage plants, preventing the vegetation from yielding seed with which to reproduce itself, thus greatly lowering the carrying capacity of the range. This carrying capacity is, of necessity, governed largely by the amount of rainfall. In years when there are ample rains there is an abundance of vegetation for grazing, but in the periods when the rainfall is light the growth of vegetation is much less. Much damage has been done to the ranges through the inability of the stockmen to reduce their herds during periods of drought.

With the exception of the western portions of Oklahoma, Kansas, and Nebraska, the carrying capacity of the range is much lower at the present time than it was in the early days, or even a decade ago. Reports from various stockmen indicate that the majority of the ranges are not carrying one-half as many animals as formerly. Ranges which formerly required from 8 to 12 acres to support a single steer throughout the entire year now usually require from 20 to 35 acres. Instances are cited in Arizona where from 50 to 100 acres are needed to support a single beef animal.[a] In western Nebraska the carrying capacity of the range is considerably higher than formerly. This is because the stockmen of that region have protected their ranges from the ravages of prairie fires.

Overcrowding the public ranges has caused considerable friction. In many sections there have been bitter fights between the sheepmen and the cattlemen. The majority of these fights were eventually settled by a division of the range and the establishing of dead lines. There have also been serious difficulties between the stockmen and the homesteaders. In some instances the stockmen tried to keep the settlers out; in other places the settlers have taken up the watering places or settled on land adjoining them, and have kept the stock from watering in their accustomed places either by building fences or by driving them away.

The stockmen have tried in many ways to adjust themselves to these conditions. Some have obtained virtual control of their ranges by buying up or leasing all the watering places. Others have been able to buy railroad land and deserted homesteads or to lease school lands, and thus bring their ranges under direct control.

In other regions, where the land could not be brought under control by these methods, stockmen have divided the ranges by mutual consent. Later they began to build drift fences on these lines in order to prevent their cattle from straying from their ranges. These drift fences were gradually extended until large tracts of Government land

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[a] Bul. 67, Bureau of Plant Industry, U. S. Dept. Agr., pp. 33 and 34.

were inclosed. The fencing in of large pastures proved to be so convenient to the stockmen in the handling of their stock that it became quite general in several of the range States.

ATTITUDE OF STOCKMEN TOWARD LEGISLATION.

Recently an Executive order was issued requiring that these fences be removed. The results of this order have greatly emphasized the necessity for some legislation which will effect a distribution of range land among those having stock on the ranges, so as to secure to them by lease, purchase, or other legal means the possibility of managing their ranges with a view to maintaining their productiveness. The stockmen, who in the absence of legislation had gradually developed a system of range division among themselves, all recognize that this division was a primitive arrangement, devoid of legal status, but made necessary by the exigencies of the business. For the most part they are heartily in favor of legislation which will give stockmen a legal right to protect whatever range may be assigned to each.

A few years ago the stockmen were bitterly opposed to any form of legislation for the division of the public domain through leasing or any other system. They felt that if they were deprived of free feed they would be unable to make a living from the range, for they could not afford to lease or purchase the feed. All they wanted was that the range should be "let alone."

Now, with the greatly changed conditions caused by overstocking and the taking up of large areas of the best range lands for farming purposes, the more progressive stockmen realize fully that unless some such step is taken the open range will soon be destroyed.

Although the majority of the stockmen now favor some form of legislation for the future disposal of that part of the public domain which is suitable for range purposes only, there is still a great diversity of opinion concerning the character of the laws needed. The greater number seem to be in favor of some system of leasing the land in individual pastures for terms of five to ten years. Nearly all believe that the area of land leased to a given person should be some multiple of the area to which he holds title in the vicinity, but that there should be a maximum limit in order to prevent any one man or company from securing control of too much land.

RANGE IMPROVEMENT.

So long as it remains public domain, and is consequently free to all without restriction, nothing can be done to improve the range land of the country, for whatever improvement might be effected would almost immediately be destroyed by the stockmen in their eagerness to be the first to profit by it. But when the land is brought under

control by lease, purchase, or other means the problem of handling the range is radically changed and the stockman is on an entirely different footing. Instead of living in uncertainty as to when his range will be a thing of the past, he will know just how much land he can use and depend upon. Then he will not feel that he must graze this land as hard as he can while he has the opportunity. Instead, he will be in position to protect it and get the greatest amount of good from it from year to year. He will then be able to fence the land and keep off all outside stock, and to regulate the number of his own grazing thereon.

Many stockmen are firmly convinced that stock can not be run at a profit in pastures that are owned or leased. Numerous citations of large cattle companies that have lost heavily in leasing grazing lands on Indian reservations are made. It is true that many of the cattle companies have lost large sums of money in leasing these lands. Careful investigation, however, will usually show some special reasons for such losses. First, the majority of these companies were handling a very poor grade of cattle. These yielded so small a margin between the cost of putting them into the pasture and the returns from putting them on the market that they could not stand the extra expense incurred in leasing. Then the cattle seemed to be unadapted to such pasturage conditions. Instead of grazing contentedly in the pastures they spent the greater part of their time wandering along the fences. Another reason for this failure, and a very important one, is that the number of acres allotted to an animal was usually placed too low, and overgrazing resulted.

In other words, these stock companies did not adapt themselves to the changed conditions. While a few men or companies have not made a success of running stock in inclosed areas, a very large number have succeeded. At the present time the most successful stockmen of such States as Texas, California, and Washington, where the free range is almost a thing of the past, run their stock in pastures.

AVOIDANCE OF OVERGRAZING.

In making the change from the open range to the inclosed pastures stockmen must not lose sight of the fact that when they have thus shut out all stray stock they have not changed the carrying capacity of the land in the least. They must therefore be careful not to overgraze the inclosed areas, which is often done from a mistaken idea that the mere fencing of a range increases its carrying capacity. The majority of stockmen using the public domain place a very conservative estimate on its carrying capacity. Yet when they come to inclose an area and pasture it, they are quite inclined to put in more stock than their estimate calls for; consequently their pastures are badly overstocked, and in some instances are actually grazed closer

than the outside range. This means not only that the pasture has been seriously damaged, but that the stock are in poorer condition at the end of the season than if they had run outside. It is safe to say that nine out of ten men changing from the outside range to pastures will overgraze their land the first season. Many of these will change their methods immediately and soon get their pastures on a supporting basis; others will take two or three years to really learn the true carrying capacity of their pastures; and still others, who can not get out of the rut, will continue to overgraze, with the result that their pastures will continually run down, while their stock grows poorer in quality from year to year.

RESTING THE LAND.

Where an area of land has been very severely overgrazed in the past it will be absolutely necessary that it be very carefully pastured for the first two or three years. The native grasses and forage plants must have a chance to regain their former vigor and to go to seed. A very large number of stockmen advocate resting the land—that is, keeping all stock off for a period of three or four years. That this remedy will bring about the desired results has been definitely proved in numerous instances. In Arizona the Department of Agriculture has a large area of land in the Santa Rita Forest Reserve that is entirely protected from stock. This area contains about 50 square miles, and includes range country that varies from very poor mesa to fairly good mountain range. Before it was fenced this area was in a very badly denuded condition. In less than two years, under protection, it has improved wonderfully. A large percentage of the new vegetation is of little value, however, as many of the seeds present were of plants not relished by stock. But the better kinds of grasses scattered among this vegetation are increasing.

In the State of Washington experiments and observation of inclosed areas covering a period of five years have shown conclusively that a given range can be very greatly improved and in some cases brought back to its original carrying capacity in from two to five years if it is properly protected. The length of time required for the range to be fully restored depends partly on how complete the overgrazing has been and largely on the amount of rainfall.

While resting will bring about the desired results, there are very few men who can afford to allow their land to remain idle for so long a period, as the taxes, interest on the investment, and cost of maintenance go on just the same whether the land is in use or not. Resting would in the end be cheaper than to continue overgrazing the land, but it is really not necessary. There is no reason why, by judicious management, the feed on such an area should not be utilized. If such a pasture be grazed very lightly during the early part of the season

until the grasses can get their growth and go to seed, it will then have a chance to improve, although this improvement may be slight. It would be much better if the pasture could be protected until the grasses have gone to seed and the seed has fallen to the ground. Then the dry feed can be utilized without damage to the range.

ALTERNATION OF PASTURES.

This improvement can best be accomplished by dividing the pasture into a number of smaller ones and alternating the stock from one to another. The number of pastures will depend somewhat on the size of the range and how it is watered. In order to secure the best results there should be not less than three pastures, while four, or even more, would be much better. In all parts of the country the more successful stockmen have a fenced area that they reserve for winter pasture, while those who run their stock entirely on their own land nearly always subdivide to the extent of a summer and a winter pasture. It is noticeable that in nearly every instance the winter pasture shows an excellent stand and produces much more feed than the summer pasture. This is solely because the grasses, being grazed only in the winter, have a chance to remain in healthy condition and also to produce a crop of seed with which to supply new plants as the old ones give way. Again, there being a good covering of vegetation, the ground is protected so that the wind and hot sun do not take all the moisture out of the ground. Instead, the moisture is utilized in growing vegetation for feed.

In Texas many of the stockmen have found that it pays them to alternate their pastures. Some even assert that with their pastures in the best of condition they carry more stock on a given area where alternation of pasture is practiced than where one big field is used.[a] Even in the East, where there is plenty of moisture, alternation of pastures is being more strongly advocated each year, as the farmers are gradually learning that their pastures can be made to carry more stock by this method.

RESEEDING THE WORN-OUT RANGE.

The problem of reseeding the range has received much attention from the Department of Agriculture. So far, experiments have shown that in the extremely arid portions of the range country reseeding is impracticable. The only method of restoring such areas is to rest the overgrazed portions. In case such ranges are grazed the year round, alternation of pastures is the only solution that can be offered at the present time. Fortunately, on account of the scarcity of water, the great majority of these areas are used only for winter pastures. In

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[a] Bul. 16, Division of Agrostology, U. S. Dept. Agr., p. 22. 1899.

this way these areas have a chance to make a good growth and to go to seed during the summer season. Thus they have ample opportunity to restore themselves in case they are not overgrazed.

In the semiarid regions, such as the bunch-grass hills of Washington, Oregon, and Idaho, and the grama-grass regions of Montana, the Dakotas, and Wyoming, alternation of pastures will be equally useful.

Ordinarily, unless the overgrazing has been very severe, the restoration process will not take many years, in some instances only four or five. If, however, the overgrazing has been complete enough to practically destroy all the native plants and has been so long in duration that no seed is left in the ground, the process will be very slow indeed, for there is nothing left on which to base improvement. Under such conditions weeds of almost no forage value are very likely to take the place of the valuable forage plants that have been destroyed. In order to prevent this, it might be feasible in some localities to gather seed of these native grasses and scatter it on the overgrazed portions. In the State of Washington, farmers have taken seed of the tall lime-grass (*Elymus condensatus*), called rye-grass by stockmen, and sown it on areas where it formerly grew. Instances are known where these men are now cutting lime-grass hay from these same areas. Experiments carried on by the Washington Agricultural College in cooperation with the Bureau of Plant Industry have shown that this could probably be done in favorable seasons with bunch-grass. In the Dakotas and eastern Montana it is quite noticeable that wherever a part of the prairie land is plowed up and then allowed to revert it will in time be covered with wheat-grass (*Agropyron occidentale*). If it is plowed and nothing else is done the wheat-grass will take possession of the area very quickly. This and the rapidity with which this grass works into overgrazed places that are rested a little show very plainly that the overgrazed areas where it grows naturally can be easily restored by reseeding with this grass. Whether the grama grasses of these regions could be restored by this process is not known. Many of the leading stockmen are inclined to believe that they could, but think it would be a difficult matter to procure the seed.

RESEEDING IN THE MOUNTAIN AREAS.

In the mountain areas, where the rainfall is much greater, the problem of restoring the range is not nearly so difficult. Where the devastation has not been too complete the range will soon restore itself if protected. On those areas where overgrazing has left the range in a denuded condition the restoration will take a number of years. It can, however, usually be greatly hastened by reseeding with some of the cultivated grasses. Experiments carried on during the past four years in the mountain areas of Washington have thoroughly demonstrated that timothy can be used to excellent advantage

in the mountain meadows and in the parks of that State where the original vegetation has been destroyed by sheep. This grass proved to be the best of a number used in reseeding the devastated mountain meadows (1) because it made the best growth and stood pasturage well, and (2) because it was the cheapest and easiest to start.

According to these experiments, the cost of reseeding land is from 60 cents to $1 an acre, depending on the amount of seed used and on the cost of getting it into the mountains. Eight pounds of seed per acre ought to give a stand that if cut for hay would yield approximately three-fourths of a ton of hay per acre. That would mean that it would yield nearly enough forage the second season after it was sown to pay for the reseeding. If the seed were sown in the autumn before snow falls it would need no further treatment, but if sown in the spring it should be harrowed in, which would greatly increase the cost.

These experiments have also proved that orchard grass and tall fescue would do well on those areas that are a little too dry for the successful growth of timothy, and that *Bromus inermis* will be of very great value in range improvement along the drier edges of the meadows and parks, provided the seed can be secured at a price that does not make it prohibitive. Redtop has given good results, but it has been very slow in establishing itself. It made almost no showing until the third year, but by the fourth season it had attained an excellent stand and was beginning to crowd out the native vegetation growing in the meadow with it. It will furnish a large amount of excellent feed in the mountain meadows.

In the Sierra Nevadas of California redtop and timothy have shown themselves to be of great value in reseeding along the edges of the worn-out and badly overgrazed meadows, provided they are not sown on those areas where there is standing water throughout the greater part of the year. Redtop seems to do especially well in the mountain areas. Judging from the results of experiments, when once introduced it will spread over a great part of the meadow and will form a dense sod that will in time crowd out other vegetation.

Orchard grass also grows very well in meadows, and also will apparently do well on some of the drier hillsides where there is not enough moisture for timothy or redtop. In fact, one of the rangers of the Sierra Forest Reserve has succeeded in growing a fair crop of orchard-grass hay for his saddle horses just on the lower edge of the timber belt, where the land has been cleared of chaparral and the conditions are quite arid.

CONSERVATION OF WATER.

The water problem is of extreme importance in range improvement, for without plenty of good water stock can not be expected to make good gains. When the land is once brought under control the

stockmen can afford to go to considerable expense to secure plenty of water. In many instances, as in parts of Montana, Wyoming, and the Dakotas, large reservoirs, or "water holes," can be made, which, with the local showers during summer, will insure plenty of water throughout the year. In other sections, as in the sandhills of Nebraska or in southern California, the water can be easily obtained by means of wells and storage tanks, the water being pumped by windmills or gasoline engines. In many sections of the country, as in Washington, Oregon, and Nevada, there are numerous springs which formerly watered a large number of cattle, but which have gone dry through the incessant tramping of stock about them. If these springs were dug out and fenced and the water conducted to troughs they could again be made to furnish an abundance of water for a considerable number of stock. The water thus stored in troughs will be kept clean for the stock and none of it need be wasted through seepage. In Nevada the digging out and protection of the springs is considered to be of the greatest importance.[a]

Every opportunity should be taken to increase the number of watering places, so that the stock using them would need to travel only comparatively short distances. In this way the range can be improved greatly, as the stock will not need to tramp over so much ground in traveling from the grass to the water and back. It will also be beneficial to the stock themselves, as the time spent now in traveling for water can be spent in resting or in feeding, and thus in making larger gains.

PREMATURE GRAZING TO BE AVOIDED.

One of the great dangers in handling range stock is the tendency of many of the stockmen to put their stock out on the range just as soon as the grass begins to start in the spring and before the ground is thoroughly settled. The vegetation, being nipped off before it gets a fair start, or, as the stockmen say, "gets strong," is greatly retarded in its growth and does not produce as much feed that season as it would if it had a better chance. Where the soil is clayey the damage caused by the premature grazing is greatly increased by the tramping of the stock, which tends to pack it into a hard layer that is impenetrable to plant roots. This packing of the soil has been one of the greatest factors in the destruction of the feed in many mountain meadows.

RAISING WINTER FEED.

In order to obtain the greatest returns from his land, the stockman of the future will need to grow enough feed to carry his stock through the winter without danger of loss and to keep them in good growing

[a] Bul. 55, Nevada Agr. Exp. Sta., pp. 14 and 26.

condition. With the extra cost of running his stock in pastures he must keep them constantly gaining, or they will prove a loss. If he can not get water for irrigation either from some stream or through storage reservoirs, such as are common in the Dakotas, that will catch enough surface water to insure sufficient pasture, he will need to grow grain hay.

Of the different cereals that can be used for hay, rye will probably prove to be the surest to yield a good crop over the greatest area of country. It will stand the hard winters of the North as well as any of the other cereals and requires the least moisture of any of them to mature a crop of hay. It can also be made to yield a fair crop with as little effort as any of the other cereals, and can thus be grown at the least cost. Many of the stockmen are greatly prejudiced against this plant as forage. This is probably very largely due to the fact that they have allowed it to get too ripe before cutting. If cut when just in the milk it makes excellent hay with which to winter stock. Beardless barley is another excellent crop to grow for grain hay. It produces a better quality of feed than rye and in some localities is preferred to any of the cultivated grasses for feed. It probably could not be depended on to produce as large a yield as rye, nor is it so certain a crop. In some sections of the country, as in the Dakotas, durum wheat will produce a considerable amount of forage in the more favorable years. In other sections many of the farmers seem to be well pleased with spelt. These last two plants are not so desirable for stock as some others on account of their heavy beards. These beards will often cause sore mouths, especially when fed to horses, and will also cause losses among sheep. In the more favorable localities wheat, barley, and oats can be grown.

In the Dakotas and eastern Montana a number of stockmen raise corn for forage and find this to be exceedingly profitable. These men are thoroughly convinced that by feeding corn fodder to their calves and yearlings they get enough better gains to pay them well for their extra work. It is noticeable that the men who are doing this are topping the markets with grass-fed cattle from their sections. This they ascribe largely to the fact that they get better gains on their young stock. In most instances these men are really raising a better grade of cattle than their neighbors, which must also be taken into consideration.

Where a little water can be stored for irrigation, brome-grass (*Bromus inermis*) produces a fair crop of hay and is becoming quite popular. This is especially true of the western half of the Dakotas. It is quite probable that with the same amount of water alfalfa would give a larger yield. Alfalfa will grow on much drier land than is often supposed. In many parts of the West the stockmen have

been trying to start this plant. Some succeed, while others fail. A large number get very poor results, as their alfalfa seems to "winter-kill" badly. Experiments that are being carried on at the substation at Dickinson, N. Dak., appear to indicate that much of the winter-killing is due to a lack of nitrogen-gathering bacteria, which are essential for the successful growth of alfalfa.[a] Alfalfa is really worth a considerable effort in order to get it started. In case of failure it should be tried again on a small scale until it has been determined whether it can be made to succeed.

AREA OF LAND NEEDED.

The area of land required to justify engaging in the stock business, without other source of revenue, varies greatly in different sections. In the northern range States, where stock must be fed for a period of three or four months during the winter season, and where the rainfall is fairly abundant, 2,500 to 4,000 acres of land would ordinarily be needed to make a fair living for a family. If the settler were fortunate in selecting a range that had not been very much overgrazed and on which there was very little waste land, he might be able to get along with only 2,000 acres. Such areas will, however, be difficult to find. In the more southern range States, where the rainfall is much less and not so well distributed throughout the season, the number of acres required for an animal will be much greater. Here the area required to support a family will vary from 16,000 acres in the better sections to 25,000, and in some cases as much as 40,000 acres are required.

IMPROVING THE GRADE OF STOCK.

Improvement of the class of stock using the grazing lands is becoming constantly more important. In the old days, when there was plenty of free range, almost any kind of animal could be sold at a profit. Under the present crowded conditions the cost of maintenance is much higher, and the poor-grade animal, or "scrub," will no longer yield satisfactory returns.

The man who is running his stock in inclosed areas or contemplates so doing in the future will find it necessary, if he is to be successful, to carry that class of stock that will net him the greatest returns. This statement holds equally true for the outside range. In fact, there are only two methods whereby the man who expects to continue running his stock on the public domain can meet the existing conditions successfully. One is the raising of sufficient feed to carry his stock through the winter safely; the other, to run a grade of stock that shall make the largest possible returns in the shortest time.

[a] For information on nitrogen-gathering bacteria see Bulletin No. 71 of the Bureau of Plant Industry.

A cattleman can no longer afford to run steers until they are 4, 5, or 6 years old, but he will need to raise quick-maturing animals that will be ready for market by the time they are 2 or 3 years old—4 at the very latest. Not only must these cattle mature early, but they must be of a quality that will dress a good percentage of beef.

This means that the cattleman will need to raise high-grade cows and supply the very best bulls he can secure—if pure bred, so much the better. In many instances the cattlemen are so crowded for range that they find it difficult to produce beef because the grass is insufficient for the steers to make rapid gains. Men in other sections find the grass of too poor a quality to fatten steers. These men will need to grow cattle for the eastern feed yards, to be sold to the feeder in the autumn as calves, yearlings, 2-year-olds, or 3-year-olds. In producing such cattle many of these men will find it necessary to improve their herds greatly, for quality and not quantity is what the eastern feeder wants. Many of these feeders complain bitterly because they can not obtain the class of cattle they need. It is noticeable that in the sales of "feeders and stockers" at Omaha, Chicago, and other stock yards those of poor quality are hard sellers and ordinarily go at very low figures.

In the South the cattlemen realize that they must cut down their herds and instead of large ones of low-grade cattle they must raise smaller and better herds. Many of the cattlemen are making this change by culling out their poor-grade cows and heifers as fast as they can.

As an example of what may be done on the open range under present overcrowded conditions, the methods of a stockman living near Reva, S. Dak., may be mentioned. A few years ago this man, becoming dissatisfied with the kind of cattle that he was running, bought a registered bull and began to grade his cattle up. By using good registered Shorthorn bulls, which he changes every three years, and by selecting good-grade cows, he has been grading up his herd until now his cattle outweigh and outsell those in his immediate neighborhood. At first his neighbors made considerable sport of him for importing registered stock and prophesied that he would make a failure of it. Instead of a failure his cattle are so much better in quality that they may be distinguished a long distance away merely by their body outline and their increased size. In order to get the most good out of his animals this man was, of course, obliged to do a good deal more work in taking care of them. He found it necessary to "line ride" his range every day in order to keep his stock from straying and to see that his bulls served his own cows and not those of his neighbors. This extra work has paid him well, as he rarely loses cattle through straying and does not need to belong to any of the round-up associations. The prime value of this work

FIG. 1.—A STALLION USED IN IMPROVING A HERD OF RANGE HORSES IN NORTH DAKOTA.

FIG. 2.—RANGE HORSES, THE PROGENY OF STALLIONS LIKE THAT SHOWN IN FIGURE 1.

is shown in his calf crop, which averages about 95 per cent, while that of his neighbors averages only about 60 per cent.

Now that the range is becoming so crowded that it is difficult to get sufficient grass to fatten steers, he is preparing to increase his breeding stock and cut down the number of his beef steers, so that when he can no longer grow beef he will be in a position to dispose of a high class of feeding cattle, which he will aim to sell as yearlings or 2-year-olds to eastern feeders. This he can do without any sacrifice whatever, as he has a type of cattle that is exactly such as the feeders want but find it difficult to obtain.

What has been said of cattle holds equally true of horses. To-day there is almost no place for the small horse or "cayuse," while good animals are in demand. That one can afford to raise good horses on the range has been demonstrated by a stockman living in western North Dakota. During a period of low prices for range horses this man bought a high-priced stallion. With this animal and nine range mares of average size and quality as a nucleus he built up a fine herd. When the stallion died he was replaced with two registered Percherons, which continued to build up the herd until it was one of the finest herds of range horses in the United States. One of these stallions is shown in Plate XII, figure 1, while some of the progeny are shown in Plate XII, figure 2. When this man got his first horse his neighbors believed that he had made a serious mistake in buying so expensive an animal. For several years, while he was building up his herd, at which time horses were of almost no value, he was considerably in debt. As his stock began to improve and the price of horses increased he began to realize well from this herd, and during the last two years he has sold geldings in carload lots at $125 a head, unbroken. In the summer of 1906 he sold his entire herd, 227 head, at $85 a head straight for all branded stock—an unusually high price for range horses. There were two mares of his own raising in this herd for which the buyers refused $550 unbroken. This man estimates that his first stallion made for him many times what he paid for it.

MOVEMENT TOWARD FARMING RANGE LANDS.

With the first extension of the railroads through the Western States large areas of land that had been previously inaccessible except for stock were taken up for farming purposes. At first only the choice areas that would grow good grain crops or those places that could be easily irrigated were selected. Within the last ten or twelve years people have learned that, by careful tillage and the use of machinery, land that had hitherto been considered of no value except for grazing can be made to produce paying crops of grain. This, together with the vast extension of irrigable lands through private enterprise and the different Government projects, has caused a heavy immigration

to these regions. If the present demand for western lands continues it will be only a short time before all of the public domain except the mountainous portions and the extremely arid sections will be taken up for farming purposes.

While the rapid strides that have been made in arid-land cultivation make it impossible to tell exactly what lands will produce successful crops for a period of several years, it would seem that many of the people who have settled in the arid regions will eventually be compelled either to give up their places or combine stock raising with their dry-land farming.

PROBABLE FUTURE OF RANGE STOCK INDUSTRY.

Present tendencies indicate that the range-stock industry of the future will be confined to those regions that are too rough for cultivation or too arid for the successful growth of crops. Except in the high mountain regions, where the grazing season is very short, or in the desert areas, where, on account of the scarcity of water, grazing can be carried on only during the winter months, the grazing will eventually be carried on in inclosed fields or on definitely assigned tracts. The stockmen will endeavor to get bodies of land large enough to support their stock, either by purchase, leasing, or, in case the homestead act should be amended to fit range conditions, by homesteading. Many living in close proximity to forest reserves will secure grazing permits, allowing them to run stock in these areas during the summer season. Wherever possible these men will raise enough feed to carry their stock safely through the winter season.

THE PREPARATION OF UNFERMENTED APPLE JUICE.

By H. C. Gore,
Of the Bureau of Chemistry.

An inexpensive method of preserving apple juice so that the product will be free from objectionable sediment and a pronounced "cooked" taste, and can be kept in closed containers without the use of chemical preservatives, has apparently never been devised. Experimental work was undertaken with a view to developing such a method, and it is believed that a satisfactory procedure has been evolved. The main problems were: (1) The clarification of the juice; (2) the sterilization of the juice; (3) the carbonation of the juice; and (4) the question as to the best containers for the sterilized product.

THE CLARIFICATION OF THE JUICE.

Fresh apple juice contains notable quantities of solid matter, which will settle out on prolonged standing, forming a bulky deposit. In the case of raw juice this consists of dirt particles, starch grains, fragments of the cell walls of the apples, and, finally, albuminous matter, yellow-brown in color and very bulky. The albuminous matter composes by far the greater part of the sediment. The character of this sediment when heated to 140° to 158° F. (60° to 70° C.) remains about the same, except that the starch grains are no longer apparent, the starch being wholly or partly gelatinized.

This sediment is very objectionable, since its presence seriously detracts from the appearance of the finished juice after sterilizing by heat. In the finished juice the albuminous matter forms slimy particles, yellow to dark brown in color, which very readily mix with the juice when agitated, and are slow to settle. The product looks as though the most uncleanly methods had been used in its preparation, whereas the reverse may have been the case. The removal of the materials which form the sediment is, therefore, one of the most important steps in the preparation of a marketable product.

The methods at present used for this purpose are two: (1) Filtration, and (2) sedimentation of the sterilized juice in large casks.

Filtration is expensive and slow, and, while a product of great brilliancy is obtained, the cost of the plant and the operation of the process will undoubtedly prevent its extended use. Paper pulp is

ordinarily employed for the filter material, and the albuminous matter in the juice quickly forms a dense layer over the surface. The ensuing filtration is very slow, and a large filtering surface is required for practical use.

Sedimentation by gravity of juice heated to 140° to 158° F. (60° to 70° C.), and then allowed to cool in closed casks, is very slow. Unheated juice can not, of course, be used, owing to the fact that fermentation soon sets in. A period of five to seven days is required to produce a juice relatively free from sediment. At this time as much as possible of the supernatant juice is withdrawn from the sediment. The objections to this method lie in (1) the difficulty of keeping the juice sterile during the sedimentation period; (2) the large amount of cooperage required for any considerable output of juice, and (3) the fact that, owing to the bulk of the sediment, considerable quantities of juice can not be drawn off. The juice left with the sediment is then only suitable for vinegar stock. In addition only partial clarification is secured. These objections to sedimentation are the result of numerous tests with barrel lots of juice.

A method of clarification which is free from the above objections, and is also cheap and may be applied on a small or large scale, is clarification by use of a cream separator. Repeated trials have shown that a cream separator can successfully clarify the juice, leaving only traces of sediment in the product. Absolute clearness of the juice is not produced by use of the machine, but practically all sediment can be removed by this process. In the experimental work to be described a hand-power cream separator of the disk type was employed. The first trial of the method indicated that a satisfactory clarification of apple juice could readily be obtained by use of the separator, and many further trials have confirmed these early indications. The suspended matter in the juice collects in the bowl of the separator, while the clean juice runs out through the milk and cream screws. After a run of the juice through the machine, the heavier particles originally present—the starch grains and any soil or dirt particles, together with some albuminous matter—are to be found tightly packed in the lower part of the tubular shaft in the bowl of the machine, while a heavy layer of albuminous material is invariably packed on the inner side of the bowl and a lighter layer on the inner side of the bowl cover. The disks remain quite free from sediment. When the space between the disks and the sides of the bowl is quite filled with sediment, the flow from the milk screw ceases and the flow from the cream screw is much increased. At this time the machine should be stopped and the bowl cleaned. The juice from the milk screw is invariably considerably clearer than that from the cream screw. The reason for this is not apparent; the fact, however, was always observed. The juice from the cream screw is, in turn, much clearer than the untreated juice.

An extended series of tests established the following facts with regard to the method of clarifying by passing through a separator, using unfermented juice and a machine of the size indicated:

First. The amount which may be run through the machine before it is necessary to stop and clean the bowl is from 25 to 40 gallons, depending on the quantity of sediment present in the juice.

Second. The rate at which the juice passes through the machine is about 45 gallons per hour, where a delivery tube of 450 pounds per hour (for milk) is employed. On fitting the separator with a delivery tube of 750 pounds capacity per hour, less perfect clarification was effected than when the smaller delivery tube was used.

Third. But very little increase in the degree of clarification or capacity for sediment was secured when juice heated to 140° to 158° F. (60° to 70° C.) was run through.

Fourth. When heated juice was allowed to stand over night and to cool and settle before passing through the separator, the supernatant juice contained much less sediment than the original juice and two to three times as much could be passed through the machine before cleaning became necessary than when unsedimented juice was used.

Fifth. Two separations are necessary when working with a separator of the size employed. The first treatment removes the bulk of the sediment, and the second takes out nearly all of the remainder.

Sixth. Running the juice more than twice through the separator improves the character of the product but little, as only very small amounts of the suspended matter in the juice are removed.

Seventh. The best conditions, as worked out by experiment, for clarifying apple juice, are as follows, working with a hand machine with a capacity for milk of 450 pounds per hour.

(*a*) The juice must be freshly expressed and, to be of high quality, should be prepared from sound, well-ripened fall or winter apples.

(*b*) It should be received in a clean barrel or cask, which must not contain any fermentation residues. This point is very important, as experience has shown that the very fine deposit formed in fermenting juice can not be successfully removed by the separator, and this deposit is difficult to clean from the sides and bottoms of fermentation casks.

(*c*) The juice is then passed through the separator, using the necessary precautions as to oiling and starting the machine, and turning the crank at the rate of 45 turns per minute. Twenty-five to forty gallons of fresh juice can be run through before the capacity of the bowl for sediment is reached. The juice which comes through the milk screw is collected separately.

(*d*) As soon as the milk screw becomes clogged the machine is stopped and the bowl is cleaned.

(e) The juice collected from the milk screw is passed through again and the juice then coming from the milk screw is collected as before.

The clarification of 25 gallons of juice, using one machine of the capacity indicated and a juice containing sediment in such quantity that a run of that amount would fill the space between the disks and the sides of the bowl with sediment, requires about one hour and a quarter, the juice passing through the bowl twice.

THE STERILIZATION OF THE JUICE.

As soon as the juice is clarified by the separator, it must be sterilized in closed containers. The points which have been carefully determined in this work have been the lowest safe temperature and the shortest period of heating for bottles and for cans.

If the juice is not to be packed and shipped, glass fruit jars, or bottles with patent stoppers, may be employed, but to stand shipping well, sealed cans or cork-stoppered bottles must be used.

STERILIZATION IN BOTTLES.

In the work with bottles, quart bottles of the champagne type were used. These were filled with clarified juice, some air space being left to allow for expansion of the liquid on heating. The bottles were placed upright and entirely submerged in water in a tank which could be heated by a jet of steam. About fifteen minutes were required to bring the water in the tank up to the temperatures employed in the several sets of experiments, namely, 140°, 149°, and 158° F. (60°, 65°, and 70° C.). After the bottles were placed in the tank from twenty-five to thirty minutes were required for the contents of the bottles to attain the temperature used. One-half hour was, therefore, allowed before beginning to count time in these tests—fifteen minutes to bring the bath up to the temperature, and fifteen minutes holding at this temperature for the juice in the bottle to attain the bath temperature. The bottles were withdrawn at intervals and set away on their sides in baskets, being kept in a warm room whose temperature was quite constant day and night, between 70° and 75° F. The bottles were agitated and notes taken on them from day to day.

The results show that a temperature of 149° F. (65° C.) for one hour will give good results and that 158° F. (70° C.) for one-half hour also gives good results. Only a very slight cooked taste is given to the juice by heating at 158° for one hour—slightly more, however, than is given by heating at 149° for the same period.

STERILIZING IN CANS.

One-gallon packers' cans were employed. These were first carefully rinsed with water, filled, sealed (rosin dissolved in alcohol being used as flux), and then heated in the same manner as the bottles. The juices employed were thoroughly typical and were clarified by passing twice through the separator. A full half hour was found by a careful test to be necessary for heating the contents of the can up to the bath when the water in the bath was cold to start with, and this period was only slightly shortened when the bath was hot at the time the cans were placed in it.

Unfortunately, the periods of heating were not short enough nor the temperatures used low enough to indicate unsafe conditions, since none of the cans spoiled; but proper treatment was found to be very readily given at low temperatures and for brief periods. It was expected that the cans which were only heated up to 149° F. (65° C.) in the hot water and then removed would surely spoil. These cans remained sound, however, and thus the period of heating indicated as sufficient for canning is unexpectedly short. When the cans were removed, they were cooled over night and allowed to stand in the same room as that in which the bottles were held. Owing to the large bulk of juice in the cans of the size employed (1 gallon), it is evident that the juice was maintained at a sterilizing temperature longer than if bottles or small-sized cans had been used. This fact must be kept in mind if the results here obtained are applied to other sizes than gallon cans.

THE CARBONATION OF THE JUICE.

In addition to experimental work on clarifying and on heating the juice, investigations were made on carbonating it with a view to disguising the slight cooked taste which it is impossible entirely to avoid. Carbonating also increases the palatability of the juice in the opinion of many persons. The method used consisted in carbonating the juice under slight pressure and then heating in bottles or cans, and no difficulty was encountered. In the simple experiments devised and carried on in connection with this work, the carbon dioxid (carbonic-acid gas) was secured from a firm handling soda-water supplies. It was obtained in liquid form in a steel cylinder furnished with a reduction valve and a gauge and delivery tube, so as to deliver at pressures up to 30 pounds.

After clarification, the juice was carbonated by pouring it into a clean keg and running in the gas up to a pressure of 15 pounds. The keg was provided with a thick pine bung, through the middle of which was bored a half-inch hole, which received the rubber delivery tube from the cylinder of compressed gas. The bung was soaked in

water for a few minutes before use, so that it could be driven in to make a tight joint, and was so fitted that it projected beyond the surface of the keg and could be readily loosened when carbonation was finished. About 12 gallons of juice were poured into the keg. Carbon dioxid was admitted before driving the bung in air-tight in order to expel the air which fills the space in the keg not occupied by the juice. The bung was then driven in by tapping with a hammer and more gas admitted. The keg was vigorously rocked so as to thoroughly agitate the juice and so accelerate the absorption of the gas.

The gauge was watched, and in these experiments the pressure was not allowed to go beyond 15 pounds per square inch. The juice used in the carbonating work was quite cool, ranging from 48° to 68° F. (9° to 20° C.) in the different experiments. As the carbonating of liquids is apparently well understood, no attempts were made to correlate the pressure, temperature, and amount of gas which could be dissolved in the juice. In these experiments the juice was carbonated at a pressure not exceeding 15 pounds until a sample was drawn tasting distinctly of the gas, this being the amount of carbonation desired. Working under these conditions in the different trials, from fifteen minutes to one-half hour was required to carbonate 12 gallons of juice. The stream of gas was then stopped, the bung cautiously loosened, the contents of the keg poured out, and the juice bottled or canned.

The gas remains for some time in the juice when under atmospheric pressure and only gradually diminishes in quantity, so that great haste in sealing the juice is not necessary. If the carbonated juice is to be sterilized in cans they must be heated in stout frames to prevent distortion of the can while hot and consequent bursting. The finished canned product bulges the ends of the cans to some extent, but not enough to cause permanent bending. The juice must not be too highly charged with the gas nor removed from the frames while still hot, or such bending, with consequent weakening of the soldered joints and bursting of the can, may occur.

THE BEST CONTAINERS FOR STERILIZED JUICE.

In the work with juice treated as above described, bottles and cans have been used as containers. The other containers which might have been tried were barrels or kegs, and jugs. Owing to the great liability to leakage and consequent infection of juice when treated in barrels and kegs, these containers are considered impracticable when the juice is to be kept indefinitely. Jugs are considered to be too cumbersome and at the same time too fragile to be handled readily in comparison with cans.

For bottles, sound corks, well soaked in hot water, should be used. These can be wired in before the bottles are heated; or tin cork holders, which may be bought on the market, may be used. The exposed end of the cork should be dipped in hot paraffin or hot grafting wax after heating, to prevent the cork from drying out with consequent serious danger of infection of the bottled juice.

No trouble was experienced in sealing the cans. As previously noted, standard 1-gallon packers' cans were employed. These had a $2\frac{7}{16}$-inch opening and were filled to within about one-quarter inch of the opening. The can was then wiped and the flux, consisting of rosin dissolved in alcohol, was applied. Hemmed caps were employed for sealing—that is, the tin cover which fitted over the opening in the can was fitted with a rim of solder. For sealing the can, a capping steel and soldering copper are required, also a gasoline furnace for heating the steel and copper, and a supply of flux, solder, and sal ammoniac.

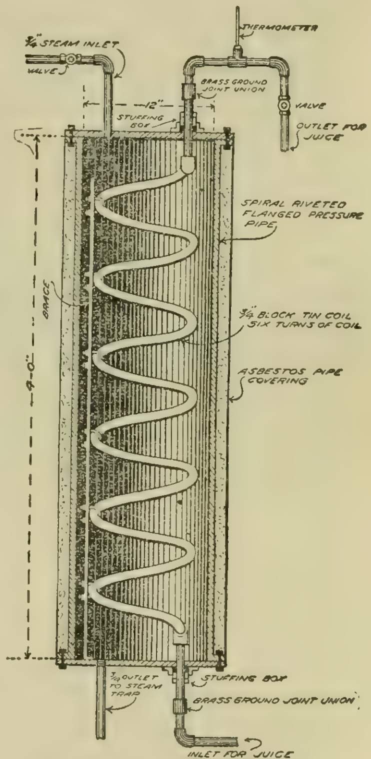

FIG. 4.—Pasteurizer for apple juice.

Barrels and kegs can be successfully used as containers for sterilized juice when it is desired to keep the juice sweet for a limited period of a few days or weeks. The cask must be thoroughly cleaned and well steamed, and filled with the juice heated to between 149° and 158° F. (65° and 70° C.). The cask can then be bunged, but considerable contraction takes place on cooling, with resulting strain on the cask and consequent increase in the danger of leakage. It is a much better procedure to close with a clean cotton plug, and when the cask and contents are cool to remove the plug and quickly insert a wooden bung which has been sterilized by soaking in alcohol. Two experiments were carried on with success with 50-gallon barrels, following this procedure. This juice kept for ten days without showing fermentation. At this time the barrels were emptied and used for other purposes.

In the experiments with barrels, and in all other work in which the juice was heated except in bottles and cans, a pasteurizer (fig. 4) designed by Mr. Given, of the Bureau of Chemistry, was employed. It proved to be a very useful machine and was capable of heating the juice with perfect control of temperature at any desired rate up to several hundred gallons per hour.

The cost of handling apple juice when it can be obtained perfectly fresh in clean barrels is slight. The only expense of separating the juice is for the labor, and if a small steam generator be used in connection with a turbine separator this cost can probably be lessened. Bottles of the champagne type cost from 3 to 5 cents each, and gallon cans cost from 4 to 5 cents each in lots of 1,000. On account of the acid nature of apple juice, the cans employed should be made of a high grade of tin plate and, as with other canned products, the juice should not be allowed to stand in the can after opening. With a view to lessening the action of the juice on the walls of the can, lacquering the inside of the can with a vegetable gum was tried. Considerably less action of the juice on the tin was noted when the lacquered can was used.

Sterilizing requires a tank of water which can be heated by steam or in any other way so that it can be easily maintained at the desired temperature. The apparatus for carbonating is simple and cheap, and the method is easy of application.

The chemical work in connection with the experiment has been to determine the composition of the juices employed and the effect of the treatment on the composition of the juice. The results of this work show that the chemical composition is practically unchanged by the treatment of clarifying, carbonating, and heating.

FOREIGN RESTRICTIONS ON AMERICAN MEAT.

By Frank R. Rutter,

Assistant Chief, Division of Foreign Markets, Bureau of Statistics.

The preeminence of the United States in the meat supply of the world has been attained in spite of obstacles of many kinds. By high tariff rates, by severe restrictions, and even by direct prohibitions, the markets of Europe have been made difficult of capture on the part of our exporters. In spite of all difficulties, the United States has come to export in a single average year a greater value of live stock and packing-house products than its six leading competitors combined in any two years.

To overcome obstacles in the way of trade expansion, it is of the utmost importance to know precisely the nature of the restrictions. To this end, at the request of the Secretary of Agriculture, the State Department, with the aid of our diplomatic representatives abroad, obtained and transmitted to the Department of Agriculture a valuable collection of the laws and regulations in force in the principal foreign countries. These enactments, supplemented by additional information obtained by a careful search through other available sources, form the basis of the present paper.

GROWTH OF MEAT EXPORTS.

The development of the live-stock and meat exports of the United States is of comparatively recent origin. During the five years ending June 30, 1870, the average exports of this class were valued at $17,000,000 (gold) and formed 7 per cent of the total exports of agricultural products. Thirty-five years later, during the five fiscal years 1901–1905, the average value of the live stock and packing-house products annually exported from this country reached over $228,-000,000 and represented 26 per cent of our total agricultural exports. The increase in this line of trade since the civil war has been continuous, and during the last five years for the first time the average live stock and packing-house products exported from the United States exceeded in value the exports of grain and grain products, ranking second in importance only to cotton. As compared with total agricultural exports, live stock and packing-house products reached the highest percentage in 1896–1900.

Four items—pork, lard, live cattle, and beef—comprise the bulk of the shipments of live stock and packing-house products from the United States, representing generally between 80 and 90 per cent of the total. The essential feature of the progress of this line of trade is the much earlier development of pork and lard exports than of the exports of cattle and beef. During the five years ending June 30, 1875, the average exports of pork and lard constituted over 75 per cent of the total exports of live animals and packing-house products, while live cattle and beef comprised only 7 per cent. During the thirty years subsequent to that period, the exports of live cattle and beef had grown to 32 per cent of the total, while pork and lard constituted 50 per cent. The rapid increase in the cattle and beef exports is illustrated in figure 5.

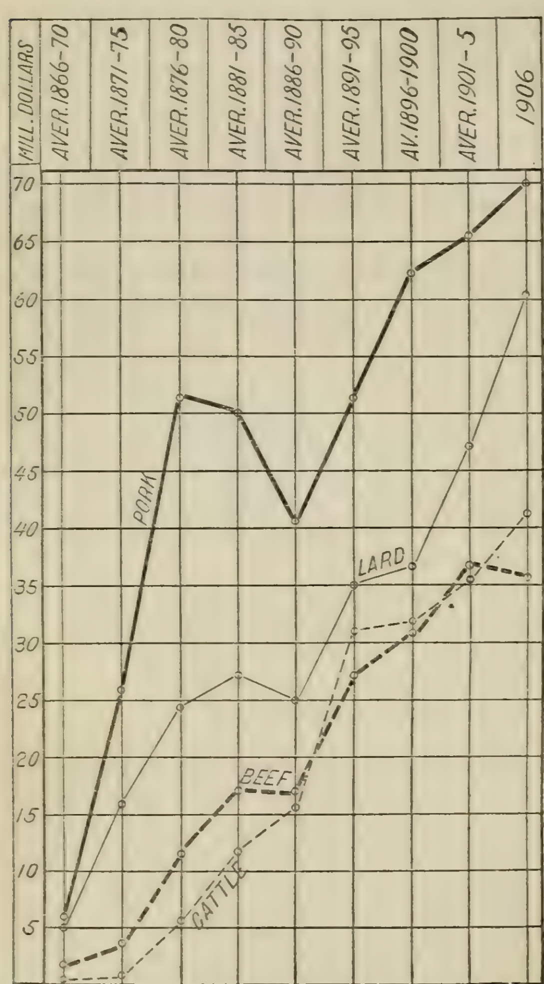

FIG. 5.—Value of pork, lard, cattle, and beef exported from the United States, 1866–1906.

The sudden rise of cattle and beef exports into importance during the years 1875 to 1880 is a most striking feature of the trade and calls for special explanation. The regular export of fresh beef in ships provided with refrigerating apparatus began for the first time in the fall of 1875 and increased rapidly. In 1877 live cattle were exported in considerable numbers. The area of grazing land available for settlement in the West and Northwest was enormously enlarged by the construction of the Pacific railroads in the late sixties and early seventies, and the increased supply of cattle called for new markets. On the other side of the ocean

the needs of the market called for new lines of supply. The United Kingdom in 1876 imported cattle (not including calves) from the continent of Europe to the number of 222,000. At that time cattle were admitted freely from most European countries and from the remainder (except Russia) on condition of immediate slaughter. The severe outbreak of rinderpest throughout Europe in 1877 decreased enormously the imports into the United Kingdom from the continent. The supply from Germany and Belgium was absolutely excluded by decree of June 27, 1877; importation from Russia was already prohibited; and the ravages of the disease cut down the number available for shipment. In 1877 the imports of cattle from the continent decreased 70,000 head. This condition of affairs warranted immediate shipments from the United States, which rapidly increased in number and soon formed an important part of the British supply. It is interesting to note that the first opening for American cattle was caused in part at least by the exercise of the power of restriction for sanitary purposes which subsequently has affected so injuriously the exports of American animals and animal products.

PROHIBITIONS AFFECTING PORK.

The important laws and decrees excluding United States meat and live stock from foreign countries fall generally into two periods, the first covering pork and the second cattle and beef.

The earliest of these regulations affecting the imports of pork, including bacon and hams, from the United States were issued during the decade following 1879. Swine products from the United States had begun to reach continental Europe in large quantities and were sold usually at prices below those charged for similar native products. For alleged sanitary reasons, several countries provided for a total exclusion of these products. On February 20, 1879, the Italian Government issued a decree prohibiting the importation of swine, pork, and hog products from the United States. Less than three months later this prohibition was made to apply generally to such products, no matter from what country imported. Portugal followed the example of Italy in March, 1879, excluding pork and other hog products used for food when imported from the United States. Hungary issued a similar order in September, 1879; Spain and Germany in 1880; France, Turkey, and Roumania in 1881; Greece in 1883, and Denmark in 1888. In 1881 the exclusion of swine, pork (including bacon), and sausages from the United States was made applicable to the entire Austro-Hungarian Empire, and in 1883 the earlier German decree was extended so as to prohibit the importation of swine and bacon and hams, as well as other kinds of pork and sausages. The Netherlands in 1885 excluded swine coming from the United States. The

prohibition, except possibly in Greece, Roumania, and Turkey, did not cover rendered lard.

The restrictions of France and Germany naturally proved most injurious to our trade. In the fiscal year ending June 30, 1881, the United States exported no less than 68,000,000 pounds of bacon and hams to France, valued at nearly $5,000,000. To Germany during the same year the exports of bacon and hams reached nearly 42,000,000 pounds, valued at over $3,000,000. The sudden stop to these important lines of trade, forcing the products to find new markets or else preventing entirely their sale abroad, led this Government to make the strongest efforts to have the restrictions removed. Special inquiry was made as to the health of swine in the United States as compared with those abroad, and the German Government was invited to name a representative on a commission appointed by the President to report upon this subject. This invitation was not accepted. The reason for the prohibitions given and tenaciously maintained by the foreign governments was that the presence of trichinæ had been discovered in American products in many cases, and that it was not then practicable to institute a sufficiently thorough microscopic inspection on importation to guarantee that no affected meat should be passed. No prospect of a modification of the decree was held out unless a thorough inspection should be instituted on the part of the United States before exportation.

In 1891 the Department of Agriculture undertook the inspection, as far as practicable, of all pork and beef for exportation. Following this action, Germany, Denmark, Italy, France, Austria-Hungary, and finally Spain, modified their regulations so as to admit swine products from the United States on presentation of an official certificate. Greece had already withdrawn its prohibition early in 1884, so that the only countries in which the prohibition of pork was maintained were Portugal, Roumania, and Turkey, while swine continued to be prohibited by Denmark, Italy, and the Netherlands.

The decade during which pork shipments from the United States were so severely restricted witnessed not merely a temporary loss. Exports to Germany, it is true, reached in the fiscal year 1898 a point higher than that attained in any previous year except 1873. In no other year, however, were the figures of 1881 equaled, and subsequently another decline occurred, bringing the exports of bacon and hams from the United States to Germany down to less than 10,000,000 pounds in the fiscal year 1905, and only 15,800,000 pounds in 1906, notwithstanding the increased shipments that took place during the early part of the year to avoid the anticipated increase in duties that took place on March 1.

In the case of France, the highest point reached by the bacon and ham shipments from the United States after 1881 was in the year

ending June 30, 1900, when the exports amounted to 14,000,000 pounds, valued at about $1,000,000, only about one-fifth of the magnitude of the trade before the prohibition went into effect. Moreover, by a considerable drop since 1900, the shipments in the fiscal year 1906 fell to 133,000 pounds, valued at $13,000. The effect of the pork restrictions is clearly seen in figure 5.

PROHIBITIONS AFFECTING CATTLE AND BEEF.

The second period of special prohibitions against American products began in 1894. In the latter part of that year various German States issued decrees prohibiting the importation of cattle and fresh beef from "America." Denmark, which since 1879 had excluded cattle from the United States, published a similar order; and Belgium prohibited the importation of United States cattle. Early the following year France likewise prohibited the importation of cattle from the United States. The cause assigned by Germany was the prevalence of Texas fever in this country. Belgium explained its prohibition by the need of preventing the introduction of contagious pleuro-pneumonia, while France attributed its action to the presence of diseases not existing in France. The magnitude of the trade thus destroyed is indicated by the fact that the exports of cattle from the United States to Germany, Belgium, and France in the year ending June 30, 1895, during part of which the trade was prohibited, were valued at $1,800,000.

The exclusion of United States cattle from Belgium was of comparatively short duration. The prohibition was withdrawn May 25, 1899, but the immediate slaughter of cattle imported from trans-Atlantic countries was required. In June, 1899, Germany prohibited the importation of fresh beef from Belgium.[a] The prohibitions of Germany, Denmark, and France are still in force, and in the case of Germany and Denmark cover fresh beef as well as live cattle.

RESTRICTIVE AND PROHIBITORY ENACTMENTS OF VARIOUS COUNTRIES.

The various countries which have raised special requirements for the admission of live stock and meat have brought about this result in widely different ways. While it is important to bear in mind the two special cycles of restriction—the first affecting pork products, the second cattle—to which attention has already been directed, it is necessary to describe separately the measures adopted by each of the principal countries.

AUSTRIA-HUNGARY'S FAR-REACHING RESTRICTIONS.

Up to the close of 1905, the great bulk of the live stock imported into Austria-Hungary came from Servia and was entered at reduced rates of duty under a treaty which terminated February, 1906.

[a] Foreign Relations, 1900, pp. 493–495.

Failure of negotiations for a new treaty was followed by restrictions and even prohibitions that practically cut off the importation of Servian live stock.

In July, 1906, foreign supplies were further reduced by decrees prohibiting in general the importation of animals and meat from countries outside of Europe, except in special cases with the permission of the minister of the interior. This restriction affects the United States, except as to swine, pork, bacon, and sausages when accompanied by a certificate of the United States Department of Agriculture attesting their microscopic inspection in this country.

IMMEDIATE SLAUGHTER OF CATTLE IN BELGIUM.

No direct prohibition of the importation of live stock or meat from the United States into Belgium is at present in force. The conditions to which the importation of live animals into Belgium from countries across the sea are subjected require their entry at Antwerp, Ghent, or Ostend, and their slaughter in the public abattoirs of those cities within three days.

GENERAL EXCLUSION BY DENMARK.

The law of Denmark is very strict in regard to the animals and animal products admitted from non-Scandinavian countries. All animals imported from Sweden and Norway, and horses imported also from other countries, are subjected merely to sanitary inspection at the expense of the consignee. Ruminants and swine from the United Kingdom and Finland are liable to "limited prohibition," which covers the importation of animals of the kinds named, sausage casings, unless air-dried and salted, horns and hoofs, unwashed wool, milk, hay and straw, and manure. From all other countries the so-called "general prohibition" of ruminants and swine, together with fresh meat and all raw products of those animals, is in force. In consequence the imports into Denmark from the United States do not include any live meat animals, and among the packing-house products cover only meat (other than fresh), lard, tallow and stearin, and oleomargarin and oleo oil. Pork and swine products not prepared, including bladders and unrefined steam lard, may be imported from the United States if accompanied by an official certificate of inspection.

FRENCH RESTRICTIONS.

The important restrictions on United States products are (1) the prohibition of cattle since 1895; (2) the requirement for salted, smoked, or pickled pork of a United States certificate of inspection, entry at one of six ports, and on arrival reinspection at the cost of the consignee; (3) the inspection of sausages from the United States, for

which, however, no fee is charged. These special restrictions, together with discriminating tariff rates, have placed the United States at a great disadvantage as compared with its competitors. In 1904 less than 10 per cent of the live animals and packing-house products imported into France came from the United States. The official export statistics of this country show a decline during the decade from 1895 to 1905 in the exports of packing-house products to France from $4,700,000 to $1,500,000. In other words, this line of trade is in value less than one-third of its magnitude ten years ago.

MEAT PROHIBITIONS OF GERMANY.

Largely because of the constantly increasing sales of American lard in Germany, the exports of American packing-house products to that country show a continuous increase since 1885. In that year $5,700,000 worth of these products was shipped to Germany; in 1895, $13,800,000 worth; in 1905, $21,900,000. Lard alone, however, constitutes over two-thirds of the aggregate value of this trade and accounts for over $10,000,000 of the total increase of $16,000,000 in the twenty years. It must be borne in mind, moreover, that the low figure in 1885 was reached while the prohibition against pork was in full force, and the subsequent increase is undoubtedly due in part to the withdrawal of that prohibition in 1891. The importation of cattle into Germany has been totally prohibited since 1894, while the importation of other kinds of meat animals is subject to four weeks' quarantine, together with subsequent supervision on the part of the Government for five months, if not slaughtered. No meat animals whatever have reached Germany from the United States since 1900, and only ten during the preceding six years.

The restrictions upon the importation of meat are much more important than those affecting the importation of animals. A general prohibition is in force since the passage of the meat inspection law of 1900 in regard to the importation of canned meat and sausages from all countries. Dog meat and prepared horse meat are entirely excluded, while fresh horse meat may be imported only when clearly marked "Pferdefleisch" (horse flesh).

While these provisions apply to all countries, the prohibition of canned meat and sausages affects particularly imports from the United States. In 1900, prior to October 1, when these prohibitions went into effect, the United States alone furnished nearly $1,600,000 worth of these products out of a total of only $2,200,000. Other restrictions affect only meat imported from the United States. In addition to the total exclusion of fresh beef from America since 1894, the importation of pork of all kinds is permitted only on presentation of a certificate of inspection.

ITALY ADMITS AMERICAN PORK AND LARD.

The ministerial decree of March 31, 1898, determines the treatment to be accorded to imports of foreign animals and animal products. The entry of cattle and sheep from South Africa, Australia, and certain European countries is prohibited, but not from Argentina or the United States. Swine from the United States, Turkey, Cyprus, Egypt, Bosnia-Herzegovina, Crete, and Denmark are prohibited, but salted or otherwise cured pork, while excluded generally, is admitted from the United States and from specified European countries when accompanied by official certificates. In all cases on arrival in Italy imports must undergo inspection, and, with the exception of lard from the United States and certain European countries, they must be accompanied by an official certificate.

PROHIBITION AND DISPENSATION IN THE NETHERLANDS.

Meat animals from France, cattle, sheep, and goats from Belgium, and cattle and sheep from Germany, may be imported for breeding purposes if accompanied by a certificate of health; otherwise such animals must undergo slaughter within twenty-four hours if imported from France or Belgium, and within forty-eight hours if from Germany. No meat animals may be imported from any other country unless under special ministerial permit.

The importation of meat into the Netherlands is nominally prohibited, but if shown not to be injurious in character it may be imported under special dispensation of the authorities in the different provinces. Apparently meat and other animal products enter the Netherlands freely and no doubt this form of regulation was adopted merely to retain full control over the character of imports.

NORWAY'S RESTRICTIONS.

Only two lines of trade in live meat animals are unimpeded: (1) The importation of reindeer, and (2) the shipment of all meat animals from the Arctic Sea ports of Russia to Finmarken, the extreme northern province of Norway, from which province animals will not be received into other parts of the Kingdom. From Sweden ruminants may be imported under numerous restrictions; from other countries neither ruminants nor swine are admitted.

The importation of meat, unless salted or prepared, and of unrendered tallow is prohibited from Austria, Italy, Greece, Turkey, Russia (except the Arctic ports when destined to Finmarken), and all non-European countries. Raw animal products, except hides and skins from Sweden, are generally prohibited.

RUSSIA PROHIBITS PORK.

Russia is essentially an agricultural country, and exports much larger quantities of animals and animal products than it imports. Since 1873 all kinds of pork products intended for food have been prohibited, with the exception of rendered lard. Under special permission of the minister of agriculture and domains, samples of foreign hog products are admitted when necessary to enable Russian exporters to compete. The ministry of the interior is authorized to prohibit the importation of live swine whenever it seems necessary.

FEW RESTRICTIONS IN SPAIN.

The prohibitions of Spain affecting meat animals and meat are few in number. From the United States unrendered lard alone is prohibited, and from Algeria the importation of swine and sausages is likewise prohibited. Pork imported from the United States with an official certificate of inspection is admitted into Spain without any further microscopic examination.

SWEDEN EXCLUDES AMERICAN SWINE PRODUCTS.

In Sweden animals and raw animal products from a place infected with foot-and-mouth disease or rinderpest are entirely prohibited, as well as such imports if in transit they have touched or passed through infected places. In the case of ruminants imported from places infected with other contagious diseases, a consular certificate and a veterinary certificate are required, and on arrival at a Swedish port the animals must be reinspected and quarantined for periods varying from 10 to 120 days. These restrictions are not enforced against the United States, because this country has not been declared by the Swedish Government to be infected with any of the diseases named.

Swine and swine products from the United States are, however, subjected to stringent restrictions, owing to the fact that the government of Sweden has declared the United States, as well as Victoria and the principal countries of Europe, to be infected with hog cholera. Live swine may be imported only if accompanied by a veterinary certificate viséed by a Swedish consul, stating that before sailing all animals on board have been inspected and found free from disease, and on arrival must be reinspected and quarantined for 60 days. Slaughtered swine and all swine products are also prohibited, with the exception of lard and well-salted pork, including bacon.

SWITZERLAND REQUIRES IMMEDIATE SLAUGHTER.

The situation of Switzerland, with no seaport, renders impossible direct importation from any countries except France, Germany, Austria, and Italy. Its restrictions and prohibitions are consequently directed primarily to animals coming from any of these countries.

Immediate slaughter, within periods varying to some extent in the different Cantons, is required. In all cases the animals and meat imported undergo inspection.

GREAT BRITAIN OFFERS AN OPEN MARKET.

Since June 3, 1898, the importation of swine from the United States into Great Britain has been prohibited, but no exclusion of other meat animals has been enforced, except during the period from December 1, 1902, to September 28, 1903, when the importation of such animals from the New England States was temporarily suspended.

Strong efforts have been made by this Government to have revoked the requirement that cattle shall be slaughtered at the port of entry within ten days after landing. While this restriction entirely prevents the importation of cattle for fattening, and undoubtedly prevents the realization of the best prices for the animals imported, it offers no discrimination against the United States as compared with any other foreign country or any British colony.

The United States now furnishes 74 per cent of the total value of live meat animals imported into the United Kingdom; ten years ago it contributed only 63 per cent. The change is due largely to the prohibition of live animals from Argentina and Uruguay since 1900, except for the period from February 3 to May 12, 1903, when the British market was reopened to La Plate cattle. No restrictive measures affect the importation of meat, and Argentina and Uruguay now furnish large quantities of frozen beef and mutton for British consumption. The fresh beef alone imported into the United Kingdom from Argentina in 1904 was valued at nearly twice as high a figure as the cattle imported in any year before the restrictions of 1900 went into effect.

The continued large shipments of cattle from the United States is a striking feature of the trade between these two countries. During the ten years ending 1904 such shipments increased in quantity 32 per cent, while the imports of fresh beef from the United States increased 45 per cent. The continued importation of live cattle in such large numbers, notwithstanding the great improvement that has taken place in refrigeration and the enormous packing-house industry of the United States, is probably due mainly to the strong preference of the British consumer for domestic meat. If home-grown meat can not be obtained, home-killed meat is preferred to foreign-killed, and this preference is doubtless rendered more possible of realization, owing to the stringent laws prohibiting the sale of food products under any misleading designation. A number of prosecutions have taken place on account of the sale of foreign for domestic bacon.

The importation of meat animals into Ireland from foreign countries or British possessions is prohibited.

FEW RESTRICTIONS IMPOSED BY NONEUROPEAN COUNTRIES.

Outside of Europe, the most important exports of live stock and packing-house products from the United States take place to Cuba, Canada, Mexico, and the British West Indies. During the fiscal year 1905 large shipments of canned beef were recorded to Japan, but with the cessation of the war in the Far East a considerable decline occurred in 1906. Of the American markets named, Canada alone restricts seriously the imports from the United States by requiring, since December 31, 1905, the quarantine of all swine for thirty days, thus cutting off the entry of United States hogs for slaughter.[a]

Cuba not only offers no impediments to the importation of live stock and packing-house products from the United States, but by special reduction in tariff offers United States animals and products a considerable advantage over those from other countries. This advantage amounts to 33 cents per 100 pounds on salted or pickled pork and lard and to 65 cents per 100 pounds on hams and shoulders.

SUMMARY OF PROHIBITIONS NOW IN FORCE.

At the present time the importation of live meat animals from the United States is prohibited by Denmark, the Netherlands, Norway, and Ireland. Moreover, Austria-Hungary, France, and Germany exclude cattle, Italy and Great Britain swine, and Austria-Hungary sheep and goats, when imported from the United States. The only European countries to which live stock are shipped from the United States in any considerable number are Great Britain and Belgium.

The importation from the United States of all meat, except pork and sausages, is prohibited by Austria-Hungary. Pork is excluded from Russia. Norway prohibits the importation of all fresh meat from the United States; fresh pork is excluded from Sweden and other fresh meat from Denmark; while Germany excludes American fresh beef. Canned meat, sausages, cured horse meat, and dog meat are prohibited by Germany, while Belgium also refuses to admit cured horse meat.

SPECIAL REGULATIONS.

In addition to orders which absolutely prohibit the importation of live stock and meat from the United States, many countries restrict in various ways these lines of trade.

In regard to the trade in live animals, enforced quarantine is required in some cases, while in others the contrary policy of enforced slaughter is observed. The former imposes a considerable expense

[a] See Monthly Cons. Repts., Jan., 1906, p. 166; also Report of Canadian Min. of Agr., 1906, p. xli.

on the importer, while the latter, by limiting the opportunity for sale and in some cases preventing the animals from fully recovering from the exhaustion of the sea voyage, operates disadvantageously upon the price realized.

Restrictions affecting both live-stock and meat imports are the requirement of a certificate, inspection on arrival, and the limitation of the ports at which such imports are admitted.

If fresh meat is imported, some countries require that the whole carcass be presented. A few countries specify the preservatives that may be used.

QUARANTINE RESTRICTIONS.

Live stock from the United States is subject to quarantine in Sweden, Germany, Spain, and Canada. Swine imported into Sweden from all countries except Finland and Norway must undergo quarantine for sixty days; Germany requires the detention of swine, sheep, and goats from America for a period of four weeks; Spain requires a quarantine of ten days before animals are admitted; Canada isolates all swine for thirty days.

IMMEDIATE SLAUGHTER REQUIRED.

On the other hand, the United Kingdom, Belgium, and the Netherlands aim to prevent any possible danger to domestic animals by requiring the immediate slaughter of the live stock imported. The United Kingdom, since 1879, has required that cattle, sheep, and swine imported from the United States shall be slaughtered at the port at which they are landed. This requirement is now general in its application, and meat animals, no matter from what country imported, must be slaughtered within ten days from their arrival without coming in contact with any British animals. Belgium requires the slaughter of all animals imported from across the sea within three days. The Netherlands imposes the requirement of slaughter within twenty-four or forty-eight hours in the case of such animals as are admitted, but live meat animals from the United States are totally excluded.

PRESENTATION OF CERTIFICATES.

The presentation of a health certificate is a prerequisite to the admission of live stock into Austria, France, Italy, the Netherlands, Mexico, and Cuba, while Mexico also requires a health certificate in the case of fresh meat imported, and Austria and Italy in the case of all kinds of meat. Sweden requires a certificate only when the animals are imported from countries infected with contagious diseases, in order to ascertain that the animals imported have not been directly exposed to contagion. Canada requires the presentation of a health certificate in the case of swine.

In some special cases the admission of swine and swine products from the United States is made dependent on the presentation of an official certificate from the Department of Agriculture. Austria requires such a certificate on the importation of swine, pork (including bacon), and sausage; France in the case of cured pork; Denmark in the case of fresh pork, bladders, and unpurified steam lard, and Spain and Germany in the case of all kinds of pork.

INSPECTION ON ARRIVAL.

Inspection of imported live animals is generally required. France and Mexico, moreover, require the inspection of all fresh meat imported; Germany, Switzerland, and Belgium the inspection of all kinds of meat, and Italy the inspection of all animal products. France provides especially for the inspection of cured pork and sausages from the United States, notwithstanding the fact that the first of these products must in all cases be accompanied by a United States certificate of inspection. On the importation of cattle, with the exception of those for immediate slaughter, the tuberculin test is required by France and Denmark.

FEES IMPOSED.

In most cases fees[a] are charged for inspection, which constitute a very considerable factor in raising the price at which the product may be sold. These fees differ widely in amount. In addition to the ordinary fees, a special charge is imposed in Germany for an examination to discover the presence of trichinæ, to determine whether a shipment is horse meat, or to ascertain the presence of forbidden preservatives. The inspection required by France on salt pork when imported from the United States, but not from other countries, entails a charge of 13 cents per 100 pounds. For the special inspection required in the case of sausages from the United States, however, no fee is charged.

PORTS OF ENTRY LIMITED.

European countries in most cases restrict the importation of live stock, and in some cases also the importation of meat to certain ports in order apparently to facilitate inspection. This requirement is general in its application by the United Kingdom, Denmark, Sweden, Germany, and Spain. Belgium, however, limits more strictly the importation from trans-Atlantic countries than from European

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[a] Fee for imported cattle, per head (cents): Belgium, 19 to 39; France, 10 to 29; Italy, 39. For imported meat, per 100 pounds (cents): Belgium, 2; France, 9; Italy, 18.

In Germany fees on live stock are of local or State origin, and differ widely. For fresh meat, per carcass (cents): Cattle, 36; calf, 12; swine, 14; sheep or goat, 10. For prepared meat, per 100 pounds (cents): Sausage casings, 5; bacon, 11; other, 22. These rates superseded on February 15, 1907, the higher rates previously in force.

countries. France restricts the importation of cured pork from the United States (which alone is compelled to undergo inspection on arrival) to six ports—Dunkirk, Havre, Bordeaux, Marseille, Boulogne, and Dieppe. A larger number of ports are specified for the importation of cattle which must be subjected to the tuberculin test, while other animals may be entered at a still larger number of customhouses.

CARCASSES OR SPECIFIED CUTS.

Belgium, France, and Germany prescribe minutely the form in which fresh meat may be imported. In Belgium such meat may be imported only as whole carcasses, halves, or forequarters with the lungs attached. As to horses and other solipeds, all the breathing organs, including the head, must be present. France requires in the case of fresh beef and pork that the whole animal be presented. For convenience of shipping, the carcass may be halved or quartered, but in these cases the parts must fit exactly and the lungs must adhere naturally. Internal organs must show no trace of scraping or scratching. Choice cuts of beef, such as the tenderloin or sirloin, may be admitted separately. Fresh mutton may be imported only in quarters, the pluck adhering to one of the forequarters.

Germany requires that fresh meat of all kinds shall be imported only in whole carcasses, but carcasses of cattle (with the exception of calves) and of swine may be cut into halves. The pleura and the peritoneum, the lungs, the heart, the kidneys, and in case of cows the udder, also must be attached to the carcass in natural connection. The importation of salted meat in pieces weighing less than 9 pounds (4 kilograms) is prohibited, but this requirement does not apply to hams, bacon, and sausage casings.

RESTRICTIONS ON THE USE OF PRESERVATIVES.

In the United States, under the meat-inspection law approved June 30, 1906, the use of drugs, chemicals, dyes, and preservatives is restricted much more stringently than in most foreign countries. The regulations issued by the Department of Agriculture under that law prohibit entirely in the preparation of meat products the use of any drug, chemical, or dye, and of any preservative other than common salt, sugar, wood smoke, vinegar, pure spices, and temporarily saltpeter.

The requirement in regard to the use of drugs, chemicals, and dyes affects export products equally with those intended for domestic consumption. In regard to preservatives, a slightly wider range is permitted in the preparation of products for export to countries in which the requirements are less strict than those in force here. To this end the law of June 30, 1906, provides—

That, subject to the rules and regulations of the Secretary of Agriculture, the provisions hereof in regard to preservatives shall not apply to meat food products for export

to any foreign country and which are prepared or packed according to the specifications or directions of the foreign purchaser, when no substance is used in the preparation or packing thereof in conflict with the laws of the foreign country to which said article is to be exported.

The United Kingdom, Austria, Italy, and Denmark prohibit in general terms the use of any ingredient that is injurious to public health, but do not prohibit any specific preservatives. The United Kingdom expressly provides that food products may contain preservative or coloring substances, provided that they are not used in such quantities as to render the article dangerous to health. Italy similarly provides that the addition of a noninjurious substance which is necessary to fit the article for sale or transportation shall not be deemed an adulteration. France prohibits adulterations in general, and specifically the use of salicylic acid and formaldehyde. Cuba by a recent law prohibits the use of all preservatives for meat except common salt. Germany and Belgium, instead of a general prohibition, name the preservatives the use of which is prohibited. These are in Germany formaldehyde, alkali and alkaline earth hydroxides and carbonates, boracic, salicylic, hydrofluoric, and sulphurous acids, hyposulphites, and chlorates. In Belgium the prohibited substances are salicylic acid, formaldehyde, sulphurous acid, sulphites or bisulphites, antiseptics, and in general substances injurious to health. It is to be observed that the greatest latitude is permitted in countries such as the United Kingdom, which are compelled to depend for an important part of their food supply on products carried long distances.

TREATY LIMITATIONS.

It is universally admitted that sanitary considerations necessitate at times the exclusion or restriction of imports from certain regions. It is not this principle, but what are deemed unjust applications of it, that have called forth protests in the past. A treaty provision guaranteeing that no prohibition shall be applied to imports from any one country unless made applicable to imports from all countries, such as is contained in the treaties of the United States with Austria-Hungary, Prussia, and other European countries, necessarily requires qualifications when actual sanitary reasons exist. Yet in the guise of sanitary needs there is undoubtedly a temptation to extend the requirements of this kind in such a way as to constitute unjust discrimination. More precise definition of the obligation imposed in this respect by the treaty guarantee of most-favored-nation privileges is urgently needed to safeguard a country against unfair treatment. An unqualified guarantee that no prohibition shall be directed against the products of an individual country is far less effective than a careful definition of the rights retained by each.

The recent treaties entered into between Germany and various European countries have clearly stated, in the form of an exception to the most-favored-nation clause, the right to prescribe the sanitary measures necessary "to protect animals or useful plants against disease or injurious insects or parasites." But, on the other hand, this right is qualified by the proviso that such restrictions "shall apply to all countries or to those countries in the same condition" in regard to the prevalence of disease and measures for its control.

In presenting the treaties to the Reichstag for ratification, the imperial chancellor emphasized the advantages gained in regard to the establishment of sanitary measures. Under the former veterinary treaty with Austria-Hungary, except in the case of rinderpest and contagious pleuro-pneumonia, Germany could not prohibit the importation of Austrian cattle unless a contagious disease within its own borders had actually resulted from such importation. Under the new treaty, prohibitions may be imposed whenever a contagious disease is conveyed from one country to the other, or whenever such a disease is prevalent in one of the countries, but in the case of most diseases (not including rinderpest or foot-and-mouth disease) may be directed only against the particular district affected, and not the whole country. The prohibitions may in no case be maintained more than nine months after the end of the infection as officially declared. The importation of cattle and sheep for immediate slaughter in public abattoirs may be prohibited only on account of the more virulent diseases, such as foot-and-mouth disease. Such prohibitions shall apply only to the particular districts affected, and must be withdrawn within thirty days after the districts have been officially declared free from the contagion. Owing to the division of Austria-Hungary and Germany into small districts in regard to contagious diseases, the burden involved in temporary prohibitions is vastly decreased, with no decrease in the efficacy of the measure.

With other countries, however, Germany retains much fuller liberty of action with regard to sanitary prohibitions. By treaty with Russia, Germany guarantees that imports from that country shall not be subjected to stricter veterinary measures than are taken against other countries, which, in regard to the prevalence of contagious diseases and in regard to veterinary control, are in the same situation as Russia. While Germany maintains a nominal prohibition against the importation of hogs from Russia and Austria, a special exemption is granted by which 80,000 animals may be imported annually from Austria-Hungary and 130,000 animals from Russia.

DISCRIMINATING TARIFFS.

As a rule the tariff rates imposed do not discriminate against the United States. At the present time no country of Europe, except France, imposes on any United States product higher rates than

those applicable to the products of its most highly favored competitor. Even in the case of France, the benefit of the lowest tariff rate is accorded to the United States on several of its leading packing-house products.

The commercial agreement of 1898 with France specified as among the products of the United States which would be admitted at the minimum rates canned meats, sausages and assimilated products, and lard. At that time a uniform duty was imposed on imports of meat animals and of fresh and salted meat of all kinds, with the exception of salted beef and mutton, on which the minimum rate of duty was very slightly below the general rate. The general rate of duty, which was imposed on this product when imported from the United States, was \$2.63 per 100 pounds, while the rate imposed under the minimum tariff was \$2.37 per 100 pounds. With the exception of this item and one or two others of merely nominal importance in our trade, the United States was put on an equality with its competitors on the French market in respect to live meat animals and packing-house products.

On July 31, 1903, a new law was passed by which the duties on cattle, sheep, goats, and swine, and on fresh and salted meat, were largely increased, while a minimum tariff rate was enacted but little in excess of the rate previously in force. In consequence of this change, United States meat was placed at a great competitive disadvantage, varying from \$1.31 to \$2.75 per 100 pounds.

The year 1906 witnessed the withdrawal of discriminating duties by two European countries. Beginning January 1, 1906, United States products were admitted into Switzerland at the lowest rates of duty and on September 1, 1906, the same treatment was first accorded by Spain.

The high level to which import duties on live stock and meat have been carried is also a factor of considerable importance. During the year 1906 no less than twelve new tariffs were put into effect by European countries. Three of these—the tariffs of Belgium, France, and Sweden—while issued in the form of new tariffs, represented in fact merely a complete revision of the tariffs already in force; two more, the Italian and Russian, left the rates on live stock and packing-house products practically unchanged; while seven—the tariffs of Austria-Hungary, Bulgaria, Germany, Roumania, Servia, Spain, and Switzerland—increased those duties very materially.

FUTURE PROSPECTS OF TRADE EXPANSION.

The present study discloses some discouraging features. Cattle and meat from the farms and packing houses of the United States are placed at a great disadvantage by the prohibitive and restrictive decrees of Germany, Austria-Hungary, and Denmark, and by the differential tariff duties of France.

But there are also features of a peculiarly favorable character. The great meat market of Europe, that of the United Kingdom, is open wide for the admission of American meat, and places American cattle and sheep on a footing as favorable as that enjoyed by any other country or by any British colony, and more favorable than that applied in the case of many of our chief competitors.

The advantage gained by the United States in obtaining for its products admission into Switzerland and Spain at the lowest rates of duty will undoubtedly prove of value to the meat exporters of this country.

It was predicted in some quarters that the complaints made during the first six months of 1906 in regard to the methods employed by some packing houses in the United States would result in a serious decline in our meat exports and in further exclusion of such products from foreign countries. Fortunately the first part of the prediction has not been realized and the second part only in a small measure. The exports of meat and meat products from the United States show an increase in the calendar year 1906 aggregating $15,000,000 over the value for the preceding year. The only product showing a noticeable decrease is canned meat, of which large quantities were exported in 1905 to Japan for use as an army ration. Except in the case of Austria-Hungary, moreover, no new restriction was decreed affecting meat imported from the United States. The trade with Austria-Hungary in meats other than pork (which was not affected by the decree) was already small, amounting to only $83,000 in the year ending June 30, 1906, and less than $22,000 the preceding year. The actual effect will therefore be much less injurious than would be anticipated from the general terms of the decree, but its potential effect in preventing any future expansion is far more serious.

Instead of leading to increased restriction on American products, the events of 1906 really afford an excellent reason for the removal or modification of the restrictions that in the past have exercised so injurious an effect on the trade in meat and live animals. The extension of the powers of the Bureau of Animal Industry in 1891 over the inspection of exported meat led to a considerable relaxation of the restrictions against American swine products. There is no reason why the stricter control now exercised over all processes of slaughtering and preparation of meat should not induce the leading foreign governments to modify the more serious restrictions and admit American meat on freer terms. Such action is more feasible because treaty relations among European countries are still undergoing revision, and within many of those countries a strong demand has sprung up for the freer admission of foreign cattle and meat.

METHODS OF REDUCING THE COST OF PRODUCING BEET SUGAR.

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INTRODUCTION.

The first refined beet-root sugar produced in commercial quantity was made about one hundred years ago, at a cost of approximately 80 cents a pound. The cost of producing cane sugar was then somewhat higher than that of beet sugar. The amount of raw sugar extracted from the beet at that time varied from 4 to 6 per cent, and the amount of refined sugar obtained was from 1 to 2 per cent of the weight of the beet. The cost of producing an acre of beets was estimated at approximately $35, while the yield was from 6 to 25 tons per acre. When it is considered that upward of 15 pounds of refined sugar can be obtained at retail to-day for the original cost of manufacturing 1 pound of beet sugar it must be realized that many improvements have already been made in the quality of the beet, in cultural methods, and in factory operations, all of which have tended to reduce the cost of the finished product.

The advances that have been made in cultural methods have been offset to a very great extent by the increased cost of labor in this country, so that the actual reduction in the cost of producing beet sugar has been due to the improvement of the beet or to less expensive operations in extracting and refining the product. It appears, therefore, that there are three avenues through which the cost of producing beet sugar may be increased or diminished. This article will deal only with those methods for reducing the cost of beet sugar which bear directly or indirectly upon the improvement and production of the raw material—the sugar beet—while the questions connected with extracting and refining the sugar will be left to the sugar chemist and to the sugar engineer.

In this connection it may not be out of place to mention the possibilities of utilizing to greater advantage the by-products of the beet-sugar factory. The first beet-sugar factory built (1805) manufactured raw sugar, wine, spirits, and vinegar. After several years of successful operation, the owner of this factory stated that if the sugar paid only for operating the factory the enterprise would still be a success. He further reported that the utilization of the beet leaves and pulp enabled him to double the number of cattle on his farm, and the

manure thus produced greatly increased the yield of his wheat. Stockmen are rapidly coming to understand the value of beet pulp as a cattle food, while the possibilities of manufacturing alcohol, fusel oil, vinegar, fertilizers, etc., from the refuse molasses have already been demonstrated. It may be that the ever-increasing demand for cheaper sugar, and the constantly advancing possibilities of utilizing the by-products, may eventually place the manufacture of sugar in that class of industries in which the factories are operated for the sake of the by-products. However, that time is far distant, and if the onward progress of this new industry is to be maintained the manufacture of sugar for sugar's sake must be fostered.

THE IMPROVEMENT OF THE BEET.

INCREASING THE SIZE OF THE BEET.

One of the most promising lines along which the cost of producing beet sugar may be reduced, so far as the question relates to the raw material, is that of the improvement of the beet. When one examines the wild beet and notes that the roots weigh but a few ounces each, he can not help wondering at the large tonnage that was sometimes produced early in the nineteenth century, when according to published reports the yield frequently reached 25 tons of roots per acre. It is true that the average yield was much below this point, but it undoubtedly compared very favorably with the present average yield of beets in this country, which according to obtainable figures is from 8 to 10 tons per acre. It would appear, therefore, that little progress has been made along this line. That the individual roots of the cultivated beet are larger than those of the wild beet there is no question; but it would seem from a study of comparative yields that the larger the root the fewer the beets which can be produced per acre. This is undoubtedly true within certain limits; but, after the most satisfactory relation between the number of beets per acre and the size of the beets has been determined, there are three methods by which the yield of beets per acre may be increased without diminishing the percentage of sugar in the beet: (1) By improved cultural methods; (2) by the use of fertilizers; and (3) by selection.

In regard to cultural methods used with sugar beets our foremost agriculturists do not agree. They are unanimous, however, in regard to the importance of early thinning. Undoubtedly many tons of beets are lost to the farmers and to the factories annually by delaying this important operation. In the use of other cultural methods we are constantly gaining new information through our experiments and through the growers' experience, which must eventually result in an increased tonnage of beets.

Thorough cultivation can not be too strongly emphasized as a factor in producing good sugar beets. It is a common saying among the

Germans that "the sugar must be hoed into the beet." While it is true that the sunshine and the air are the principal factors in sugar production, the cultivator and the hoe are important aids in keeping the beet vigorous and active. At no time in its life should a beet be allowed to cease growing, for if it once becomes stunted it is doubtful whether it will ever make as good a beet as it would have been under conditions of continuous growth.

Numerous experiments have been conducted by the United States Department of Agriculture, by the State experiment stations, and by growers to determine the proper relation between fertilizers and the sugar-beet crop. While there is still much to be learned in regard to fertilizers, there can be no doubt about the benefit to be derived from their judicious use with sugar beets.

The rotation of crops is an important matter in the growing of sugar beets, and while the rotations must necessarily vary in different localities there should always be some green crop in the rotation, preferably a legume, that can be plowed under to furnish humus and to supply at least a part of the nitrogen..

Having done everything possible by means of cultural methods and by the use of fertilizers of different kinds, there are still promising possibilities in the selection method. By this process, in which experiments are already under way in the Bureau of Plant Industry, it is proposed to select for seed production large beets rich in sugar, and by repeated selection and crossing to produce a strain of beets that will greatly increase the yield without any decrease in the sugar content of the beets. The results should be a much larger quantity of sugar per acre without any increase in the cost of production.

INCREASING THE SUGAR CONTENT.

Another possibility of improving the beet is to increase its sugar content. If this is done, even without increasing the size of the beet, a greater yield of sugar per acre may be obtained. When the percentage of sugar obtained from the beet a century ago is compared with the present sugar content of our cultivated beets, it is seen that much progress has already been made in improving the beet in this direction. A comparison of the average percentage of sugar actually obtained from the beet with the high sugar content of the best samples indicates that there is still opportunity to greatly increase the average sugar content of our beets.

If a largely increased yield of beets is combined with a much higher sugar content it is entirely possible to obtain three times as much sugar per acre as is produced on an average at the present time. For example, the present average yield of beets per acre in the United States is about 10 tons, and the percentage of sugar actually extracted and refined does not exceed 12, making the average yield of sugar per

acre approximately 2,400 pounds. Yields of more than 30 tons of beets per acre are sometimes obtained, and yields of more than 20 tons are common. From 20 to 25 per cent of sugar in the beets has been reported so frequently that it is safe to assume that an average sugar content of 18 per cent is within the limits of possibility. If an average yield of 20 tons per acre and an average sugar content of 18 per cent could be reached, we would have an average yield of 7,200 pounds of sugar per acre. If this could be realized without increasing the cost of growing the beets, it should be entirely possible for the grower to furnish the raw material to the factory at a somewhat lower cost than is at present practicable. This is the first important step toward reducing the cost of sugar production.

One of the most important factors in producing a beet rich in sugar is the proper selection of beets for seed production. This is the seedsman's problem, and is, under the present methods of beet-seed production, entirely outside the province of the grower of factory beets. However, the sugar content of beet roots depends to a very great extent upon the soil and climatic conditions. For example, in 1903 the Bureau of Plant Industry planted several varieties of sugar-beet seed on the Arlington Experimental Farm, near Washington. This seed was produced from beets that tested from 16 to 18 per cent of sugar. The beets grown from the seed tested in no case more than 12 per cent of sugar, and nearly all the samples tested less than 10 per cent. These beets were sent to Utah and planted for seed in 1904. The beets grown in 1905 from the seed produced from these roots tested 16 to 17 per cent of sugar. It will be seen, therefore, that while the beet still possessed the tendency to produce a high sugar content, the soil and climatic conditions in the vicinity of Washington, D. C., in 1903 kept the sugar production too low for practical purposes.

If the climatic conditions in any locality appear to be unfavorable for sugar-beet production, it is not advisable to undertake to grow sugar beets on a commercial scale until a beet has been developed by selection or otherwise that is adapted to that particular locality. It has been found that clay loams and sandy loams are very satisfactory for sugar-beet production, provided other conditions are favorable; but more depends upon the physical condition of the soil and upon methods of cultivation than upon the particular kind or variety of soil used. The soil should be well supplied with humus and well drained.

COST OF GROWING BEETS.

LAND VALUES.

In considering the methods by which beet sugar may be produced at a smaller cost so far as the raw material is concerned, there are certain factors which tend to increase rather than to diminish the cost of production. One of these is the increase of land values. During

the past decade there has been a remarkable advance in the price of farming lands, especially in those localities where beet-sugar factories are in successful operation. These lands have become more valuable not only because they produce large quantities of sugar beets, but because there is a ready market for the crop and because other valuable crops form with the sugar beets a very satisfactory rotation. There are thousands of acres of good farming lands where sugar beets may be grown with profit as soon as sugar factories are constructed.

Five years ago the land in a certain valley in Utah was offered for sale at $20 an acre. Since that time a sugar factory has been built, and from 6,000 to 8,000 acres of sugar beets are grown in that valley annually, bringing to the owners a return of $75 and upward per acre. As a result, practically none of the land is for sale at the present time. If by force of circumstances a tract of this land changes hands, the price obtained is $100 or more per acre.

In some parts of Colorado sugar beets, potatoes, and alfalfa form a rotation series to which small grains are sometimes added. When it is realized that potatoes often yield from 600 to 800 bushels per acre and sugar beets upward of 20 tons per acre, it is not surprising that this land is held at several hundred dollars per acre; and it may be stated that in none of the sugar-beet areas is the price of land decreasing.

The theory that sugar beets will ruin the land has long since been exploded. The best crops of sugar beets and other farm products are found on many of the farms where sugar beets have been grown longest. This is in part due to the fact that good farmers have become better farmers through their experience in growing beets. Proper rotation of crops, good cultivation, and the judicious use of fertilizers are the factors that keep the land in good condition and enable farmers to obtain the highest possible returns for the labor and money invested. The situation in regard to land values, so far as they relate to sugar beets, may be stated as follows: Inasmuch as sugar beets require the best quality of soil and demand that it shall be in the highest state of cultivation to produce the best results, sugar beets must remain a comparatively high-priced crop, and any attempt to reduce their price must result either in producing an unsatisfactory crop or in eliminating sugar beets from the system of crop rotation in many localities.

COST OF LABOR.

Another factor which up to the present time has had a tendency to increase rather than to diminish the cost of sugar-beet production is the cost of labor. The price of farm labor, like land values, has increased materially within the past few years. This is especially true of hand labor for thinning, pulling, and topping beets. In view of the greatly increased cost within the past decade of nearly all the

necessaries of life, and with every indication that the cost of living will not be materially reduced in the near future, it can not reasonably be expected that farm wages will be appreciably lowered within the next few years, at least. It is clear that the increased cost of labor thus far has had a tendency to increase rather than to decrease the cost of beet sugar.

AMOUNT OF LABOR.

Another phase of the labor question should be considered in this connection, and that is the amount of labor required in growing an acre of beets in order to obtain the greatest profit from the crop. The average cost of growing and harvesting beets at present is estimated to be approximately $30 per acre. It would undoubtedly be poor economy to lessen the cost of growing beets by reducing the amount of labor per acre under the present conditions. There are some indications that a still larger expenditure of labor upon the crop would produce a much greater return. For example, several years ago one of the leading agricultural papers of this country offered a series of prizes for the best crop of sugar beets to be grown under certain conditions. One of the winners produced approximately 30 tons of beets on an acre of ground. The total cost of growing this acre of beets was nearly $60. A little reflection will show that a much larger profit per acre was obtained in producing 30 tons of beets on a given area at an outlay of $60 per acre than would have been made by spending $30 in growing the present average tonnage on the same area. From this and other examples that might be cited, the conclusion is obvious that the production of sugar per acre may be increased by increasing the amount of labor per acre in growing the beets.

SOURCES OF LABOR.

The question of obtaining a sufficient number of the right kind of laborers to grow the sugar-beet crop has become one of the most complex and at the same time one of the most important problems in connection with the sugar-beet industry in nearly all the beet areas in this country. Scarcity of labor has an important bearing upon the cost of sugar production in several ways, but especially in delaying the work and in leaving certain operations undone, thereby reducing the yield of sugar per acre.

In some localities no difficulty is experienced in obtaining a sufficient number of suitable laborers throughout the season, especially in those sections where the farms are small and the country is thickly settled with good farmers. Under these circumstances the individual farmer is usually found growing a small acreage of beets—frequently not more than from 3 to 10 acres—which he is able to care for with his own family, with possibly some assistance now and then from his neighbors. In this way beets are grown more satisfactorily as

regards labor than in any other. In most of our sugar-beet sections, however, it is necessary to depend to a greater or less extent upon outside help. Just how this labor is to be secured, how it is to be retained throughout the season, and how it can be made a permanent factor in the sugar-beet industry are problems upon the correct solution of which the future of the beet-sugar industry depends to a very great extent. Efforts are being made to work out these problems in the various localities where help is needed; and, while the conditions in the different sections are not identical, a brief review of some of the important methods used may be helpful.

In the Middle and Eastern States, and in some of the Western States, a large part of the labor in connection with sugar beets must be done during the summer, at which time a large number of pupils and teachers from the public schools are available for the work. Many growers take advantage of this fact, and hundreds of school children are employed annually in thinning, weeding, and hoeing beets. In some localities the teachers, both men and women, spend a part of the long vacation in the beet fields, much to their advantage physically as well as financially. When this kind of labor can be employed it is generally satisfactory, and improves from season to season with the experience gained. Unfortunately there is not enough of this kind of labor to supply the demand, and in a few localities it is reported unsatisfactory.

If the sugar-beet area is located near one or more large cities a considerable portion of the temporary labor comes from that class of city residents who have no permanent employment and who are willing to go out and work in the fields. This is especially true of certain members of the foreign population, both men and women, who often make excellent farm hands. Most of these laborers insist upon returning to their homes in the city at the close of the day. Numerous instances might be cited of Polish women who walk from 2 to 4 miles in the morning in order to do their day's work of thinning, hoeing, or topping beets, or other farm work that their employer may require. (Pl. XIII, fig. 1.) At the close of the day they walk back to their homes only to repeat the same operation the next day and each day throughout the season. Some of the employers state that this is the best class of labor that they are able to obtain on their farms.

Some of the laborers become very skillful at this kind of work; others were familiar with it before coming to this country and depend from the first upon finding employment of this kind. However, many of these laborers are seeking permanent employment in the factories and other enterprises in the city, so that this class of farm labor is in constant danger of depletion. At best this kind of labor is limited by the number of people who are willing to go out from

the city and do work of this kind, and also by the small number of farmers who are near enough to the city to allow the laborers to return home at the close of the day. If some of the farmers living farther away from the city could induce some of these families to become permanent residents of the rural districts it would undoubtedly be mutually beneficial in many cases. Various methods are being used in different places to accomplish this result. In one section where labor is scarce the officials of the sugar company suggested that each farmer build at least one tenant house for the accommodation of some of the labor required. The farmers are acting upon this suggestion, and undoubtedly within a few years this community will be well supplied with good labor.

It is well known that many families, especially those of foreign birth, hesitate about going into the country for the reason that they would, in a way, become practically isolated from their countrymen. In order to overcome this difficulty and at the same time to solve the labor problem for the sugar-beet industry, several sugar companies have purchased large tracts of land and have offered various inducements to laborers to settle upon the land in colonies. For example, one sugar company divided its land into small farms of 40 acres each, which were sold at a low price on easy terms. The only requirement was that the purchaser should grow a small acreage of sugar beets for at least two years, upon the presumption that if beets were grown for two years the purchaser would be a permanent grower. This plan, which was started four years ago, worked out satisfactorily. All the land was sold and each year upward of 6,000 acres of sugar beets are grown for the near-by factory.

In another sugar-beet section the sugar company has divided its land into small farms, which it has equipped with the necessary stock and tools and on which it has built comfortable houses. These places are rented to farmers, who are growing small areas of sugar beets. This plan is working satisfactorily for the sugar company and, like the preceding method, is of inestimable benefit to many families desirous of becoming independent citizens.

Still another sugar company has set apart a portion of its land with a view to forming a Russian colony. This land is divided into acre tracts, and a small house is built on each tract. Figure 6 shows four of these houses; that is, the two buildings shown consist of two houses each, placed side by side. These houses are rented to Russian families with the definite understanding that when a family has worked for the company a given number of years a deed for the house and lot will be given to that family. This plan is of comparatively recent origin, and the effect that it will have upon the solution of the labor question is still problematical. If there is any disadvantage in this plan over the preceding ones it undoubtedly lies in the fact that

the tract of land is not large enough to support a family; hence, the workers must seek employment on other farms, necessitating the expenditure of considerable time and energy in getting to and from their work.

In the same community another plan has been adopted which promises good results. The important point, the nucleus of this plan, is a portable house. The outfit, as shown in figure 7, consists of a farmer's handy wagon, the wheels of which are 28 inches in diameter and have a 5-inch tread. The construction of the house is shown in the cut. The outfit consists of a laundry stove, cooking utensils, woven-wire folding cots, mattresses, and blankets. Each house will accommodate from two to five workmen, and costs about $75. The laborers occupying one of these houses contract to do the hand work for several beet growers at a price ranging from $18 to $21 per acre, depending upon the number of hoeings, etc., included in the contract.

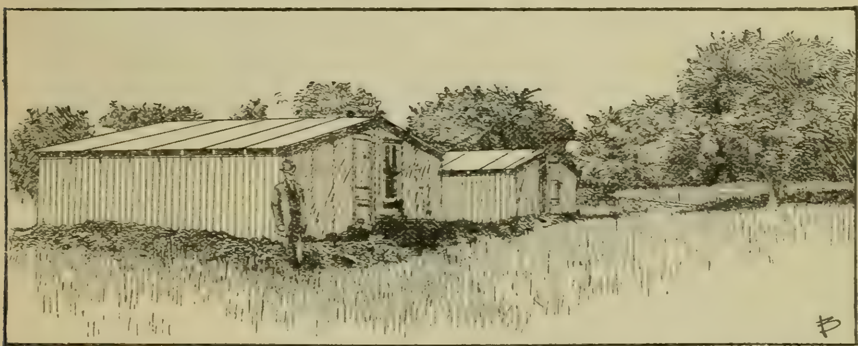

Fig. 6.—Laborers' houses, one to each acre tract—one method of solving the labor question in growing sugar beets.

The agreement is that when they have finished one operation, such as thinning, for one farmer, he will take his team and haul the house to the next farm. This house is portable, not only in the sense that it is on wheels, but also from the fact that it is capable of being taken down and shipped on the cars. In this way it is easily shifted about from community to community, to the place where it is most needed.

The laborers using these houses are mostly Belgians, who seem to be very satisfactory in the beet fields in most instances. They are tireless workers, and when employed by the acre often utilize every moment of daylight in caring for the beets under their contract. Their method of topping beets, as shown in Plate XIII, fig. 2, is one that seems to be peculiar to themselves, and is very rapid. The beets are pulled and thrown in rows, with the tops all one way, and then in a bent position, as shown in the illustration, the laborers go up and down the rows, cutting off the tops and throwing the beets into piles. The two brothers shown in the illustration were photographed in 1904

while working on one of their contracts. This year (1906) they rented a 40-acre farm and are growing their own beets. It is safe to predict that within a few years they will be landowners and employers of labor.

In still other communities large numbers of Japanese are employed for sugar-beet work. For a given community the Japanese are usually contracted for through their leader, who agrees under bond to furnish so many laborers for the hand work at some stipulated price. This price is about the same in all the sugar-beet sections—$20 per acre. This army of laborers, often consisting of several hundred under one contract, may be, and usually is, divided into smaller squads, which are sent to the various fields where they are needed. They usually form a camp in which they live by themselves. Under the direction of a competent foreman they are capable of doing excellent work, but

FIG. 7.—A portable house used in solving the labor problem in some parts of the sugar-beet area.

they sometimes become careless and trifling, in spite of everything that may be said or done.

Many growers in the West speak very highly of the Chinese as laborers in the sugar-beet fields, but owing to our present immigration laws they are necessarily very scarce, this being especially true of the younger and more active members of the race.

REDUCING THE COST OF LABOR.

The high price of labor, as well as its scarcity, has acted as an incentive to change the structure of beet seed and devise other means whereby sugar beets may be grown with less hand labor. While it has been shown that all the labor performed in producing a crop of beets is necessary in order to obtain the best results under present conditions, it may be possible to perform one or more of these various operations in some other manner with just as good or even better results than at present and at less expense. For example, the production of single-germ beet seed is but a method of thinning beets before the seed is planted.

FIG. 1.—POLISH WOMEN THINNING BEETS.

FIG. 2.—BELGIAN METHOD OF TOPPING BEETS.

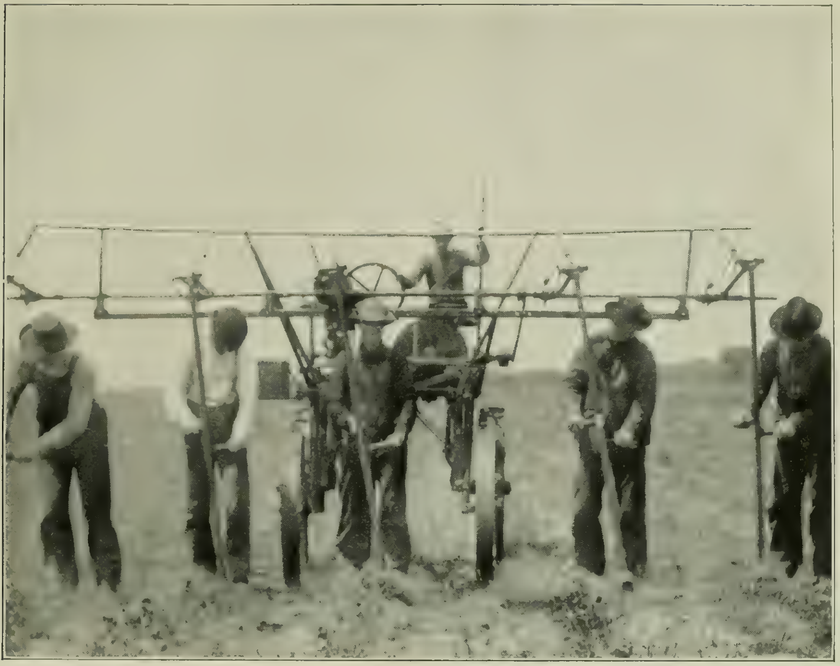

FIG. 1.—POWER HOE THAT MAY BE UTILIZED IN BLOCKING AND HOEING SUGAR BEETS.

FIG. 2.—SILOING SUGAR BEETS FOR THE FACTORY.

Production of single-germ seed.—Commercial beet seed consists for the most part of from two to seven individual seeds welded by nature into one mass. It is evident that plants produced from such a mass of seeds must necessarily be very close together, and thus far no mechanism has been devised whereby the plants can be properly thinned. It is clear, therefore, that if we expect to do away with the hand thinning of our sugar beets it can probably be accomplished only by changing the construction of the seed ball, either naturally or artificially, so that there will be but one germ in each ball. Repeated efforts have been made to break up the seed balls by passing them through various forms of rollers and grinders so that each seed could be planted by itself. The seed coats are so hard that any device that has been tried thus far that will crush or break the seed ball breaks a large number of the seeds and renders them useless.

An effort is being made by the Bureau of Plant Industry to produce a single-germ beet seed by selection. The results of this work up to the close of last season (1905) are reported in Bulletin No. 73 of the Bureau of Plant Industry, in which it is shown that the percentage of single-germ seeds has been increased from less than 2 to upward of 25 per cent.[a] In the light of the advance that has already been made it is reasonably safe to assume that this object will finally be accomplished by this means. After a plant possessing single-germ seed balls has been produced it will necessarily be a number of years before a sufficient quantity of this seed can be produced so that it can be used commercially.

Thinning.—Meantime, as the industry grows, there will be an ever-increasing demand for hand labor for thinning the beets. Many growers have not yet learned the importance of early thinning, and consequently they try to do the work with an insufficient force, letting this operation, which should be done within a few days, extend over a period of several weeks, much to the detriment of the yield and consequently to the returns from the crop.

Hoeing.—The number of hoeings given a crop of sugar beets varies from two to five. A single hoeing is much less expensive than the single operation of thinning or of harvesting, but the total number of hoeings, if properly done, will cost more than either of the other operations. It is important, therefore, that something be done to reduce the cost of hoeing sugar beets. As already pointed out, it would be poor economy to reduce the cost of hoeing beets by giving them a smaller number of hoeings or by doing the work less thoroughly. On the other hand, there are indications that better beets could be grown

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[a] Since this paper was written the single-germ seeds produced in 1906 have been separated and counted, and it is found that several of the plants yielded upward of 49 per cent of single-germ seeds. A large number of the plants produced more than 30 per cent.

if more attention were given to this phase of sugar-beet culture. If anything is to be gained over the present method of hoeing beets it must be by means of a machine that will do the work more thoroughly or at a lower cost per acre. A power hoe has recently been invented and successfully used in the cotton fields. Although not yet tried in connection with sugar beets, it would seem from its construction that it could be used to considerable advantage in the beet fields. This hoe consists of a metal disk which may be forced into the ground to any desired depth, and is made to rotate rapidly in a plane parallel to the surface of the ground. The power that causes the disk to rotate is furnished by a gasoline engine, while the movement around the plant is guided by the human hand, as shown in the illustration. (See Pl. XIV, fig. 1.) It is claimed for this machine that from five to six times as much work can be done per day with one of these hoes as can be done by the same man with a hand hoe. If this particular implement is not adapted to sugar-beet work it will doubtless lead to something whereby artificial power may be used in blocking and hoeing sugar beets.

Cultivating.—Several cultivations are necessary in the growing season. The number of cultivations and the depth and distance from the beets that the teeth of the cultivator should operate are moot questions among agriculturists. It is agreed that different conditions require different treatments, and hence the expense of cultivating beets must depend somewhat upon soil and weather conditions. However, the single cultivator has given way to a great extent to the two-row cultivator, and recently a four-row cultivator has been devised and put in operation, so that the cost of each cultivation is greatly reduced. The initial cost of the four-row cultivator is greater than that of a single-row cultivator, but the additional outlay is soon made up if there is a considerable acreage of beets to be cared for.

Harvesting.—Harvesting sugar beets consists of three distinct operations, viz, lifting, pulling, and topping. For many years lifting or loosening the beets has been done by horse power. In some parts of the West steam power is now being used for this purpose. Two kinds of lifters are in general use, one consisting of a side plow, which passes along one side of the beet row and loosens each beet by pressing slightly against it and at the same time plowing it up. The other form might be described as a plow with two points or shoes, so arranged that as they pass along on either side of the beet row each individual beet is caught between the points and lifted slightly, so that it is left perfectly loose in the ground. The beets must then be pulled and topped by hand.

Many forms of beet harvesters have been constructed, but none has come into general use. It is the aim of the inventor of the beet harvester to perform the three operations at the same time.

Some inventors aim to top the beet and then pull it, while others maintain that the beet must be first pulled and then topped. If the beets are topped and afterwards pulled, there seems to be some difficulty about getting all of them out of the ground. On the other hand, if the beets are first pulled and then topped, considerable difficulty is experienced in topping them correctly, owing to the variation in the size of the beets and the difference in the length and size of the crowns. Several new harvesters are in the field this year (1906), and it is probably a question of only a few years when the harvester in the beet field will be as common as it is in the grain field. The cost of hand work in harvesting beets is from $5 to $8 per acre. It must be remembered that no machine annihilates the cost of any farming operation, but that a satisfactory beet harvester would greatly reduce the expense of harvesting the crop is evident.

Transporting to factory.—Another important factor in the cost of producing the raw material is the expense involved in transporting the beets from the farm to the factory. If the field is located near the factory and the roads are level and well made the beets may be delivered at a minimum cost. As the distance from the factory increases, more time is consumed, and consequently the expense is increased. The importance of good roads can not be overestimated. It frequently happens that the fall rains begin before the beets are delivered, and unless the roads are well made they are soon full of holes and ruts that make it impossible to haul more than half a load at a time, practically doubling the expense of delivering the crop. One effect of the sugar-beet industry is the improvement of the country roads, and conversely the improvement of the country roads is an aid to the sugar-beet industry.

Railroad facilities and rates play an important part in the cost of delivering the sugar-beet crop. Very few factories grow all their beets within hauling distance. The grower and sugar company are fortunate if the railroads so radiate from the vicinity of the factory that the beets grown in a given community can be brought in over one line of road. It is often the case, however, that the cars must be sent over two or more roads, which necessarily increases the expense. It too often happens that there is an insufficient supply of cars at the time they are wanted or the cars furnished are not adapted to handling sugar beets; consequently considerable time is lost in loading and unloading the beets. All these things are adjusting themselves gradually to the betterment of the industry through the persistent efforts of those interested.

Destroying weeds.—The improvement of farming methods has been mentioned as playing a significant part in sugar-beet growing. One point that should be emphasized in this connection is the importance of destroying weeds. This work should not be confined to the

beet fields. Adjacent fields, roadsides, fence rows, and vacant lots should be watched and the weeds destroyed before they go to seed. It is not uncommon to find beet fields that are in fairly good condition while the roadside just over the fence is full of weeds. Some of the seeds of these weeds will certainly be scattered by various agencies over the field and be ready for growth the next year. The destruction of weeds for a single season will not always produce appreciable results, for the reason that a large number of weed seeds remain alive in the ground for a number of years. Persistent efforts in destroying weeds, however, will result after a few years in greatly reducing the labor of keeping beet fields free from these pests.

Siloing the beets.—Another expense that must be reckoned with under certain circumstances is that of siloing the beets. This becomes necessary when the beets must be harvested faster than they can be handled at the factory. It will be seen at once that siloing the beets necessitates an extra handling of the crop, since they must be reloaded into the wagons and hauled to the factory or dumping station. Inasmuch as siloing factory beets has not yet come into general practice in all of the beet-growing localities, a fair idea of the methods employed and labor involved may be gained by referring to Plate XIV, figure 2. In addition to the extra expense involved, which varies from 20 cents to $1 a ton, there is more or less shrinkage in weight due to evaporation. To avoid the expense and loss incident to siloing the beets an effort is being made by the Bureau of Plant Industry to lengthen the harvesting season by producing an early-maturing beet. It is hoped by this means to so distribute the ripening period that the factory will be able to handle the beets as soon as they are harvested.

SUMMARY.

While the methods of cheapening the process of making beet sugar can not be adequately treated in a short article of this kind, the principal points to be aimed at may be summed up as follows:

(1) Increasing the tonnage without increasing cost of production.

(2) Improving the quality of the beets without additional expense.

(3) Improving the beet in size and quality, or both, at additional expense, but in such ratio that the gain is greater than the outlay.

(4) Providing a sufficient quantity of suitable labor at the proper time so that the beets may be kept growing without interruption.

(5) Modifying the beet seed so as to render thinning unnecessary.

(6) Modifying the beet so that siloing for the factory will not be necessary.

(7) Devising machinery that will do away with hand labor.

(8) Improving farming methods and operations so that less labor will be required to produce the crop.

(9) Improving wagon roads and railroad facilities.

CORN-BREEDING WORK AT THE EXPERIMENT STATIONS.

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Of the Office of Experiment Stations.

The corn produced in the United States each year is worth more than a billion dollars—nearly twice as much as any other crop. This immense resource has been practically created since the United States has existed as a nation. Corn was cultivated by the Indians before the Western World was discovered, and hence was the first of the common cereals to be grown under the care of man on American soil. The most rapid development in corn production, however, has taken place during the last forty years, the annual yield for the entire country having approximately trebled during that time. The vast increase in production is of course mainly due to the increase in the acreage devoted to corn culture, but it may also be attributed in part to improvement in the plant itself. Ever since corn came under the beneficent influence of agriculture, such improvement has been in progress, at first unconsciously and later consciously, but with the principles of corn breeding very little understood. The earlier work, which was of slow progress, adapted the crop to a wider range of latitude and assured greater success in its culture over large areas, particularly in the northern portions of the corn belt. While we are still far from completely understanding the principles underlying the improvement of the corn plant by breeding, the work of the experiment stations has elucidated the subject to a considerable extent and has shown the farmer how to apply the principles already demonstrated.

During recent years the improvement of our corn varieties has become a matter of great general interest among experiment-station men and progressive farmers. There has been a sort of agricultural awakening, largely due to the realization of what can be accomplished with a crop of such magnitude and one so ready to respond to intelligent treatment. Experimental work in agricultural lines, especially if its results are to be far-reaching, generally requires considerable time for the accumulation of data, their verification, and the dissemination and application of the information secured, but in the work of corn improvement the stations have been successful in interesting the farmer, and even the general public, in a comparatively short period of time.

GENERAL FEATURES OF THE MOVEMENT.

An increase in yield is brought about by bettering the environment of the plant or by improving the character of the plant itself. All improvement within the plant is based, on the one hand, on variation or the tendency of offspring to differ in some respects from parents, and, on the other, on heredity or the tendency of progeny to possess characteristics in common with parents and other blood relatives. That the corn plant has undergone a marked change since the beginning of its culture is unquestionable. Until quite recently all of the corn crop was harvested by hand, which gave the grower an opportunity to observe all the larger, well-formed ears, and to select the best appearing ones for seed. Simple selection of the ears was the beginning of corn improvement and the only method followed from the earliest periods of American agriculture. It is not surprising that artificial crossing was not employed in the early improvement work when we consider that it was only a little more than two hundred years ago that the sexuality of plants was discovered and that the manner of manipulating the blossoms in the process of cross-breeding was even then not so well known either inside or outside of scientific circles as it is at present. Only during the last century has this knowledge found a more or less large and direct application in the improvement of cultivated crops.

It was by constant and continued selection for a long series of years that many of the common and well-known varieties, such as Reid Yellow Dent, Golden Eagle, Iowa Silver Mine, Leaming, and Boone County White, were brought to their present high standard of perfection, with their characteristics generally well fixed and uniformly reproduced, thus showing that marked improvement in varieties of corn may be brought about by selection without crossing. Cross-breeding has entered into the origination of some of the standard varieties, as, for instance, Riley Favorite, established a little more than twenty years ago, which is a hybrid resulting from a cross between Golden Yellow, a large late variety, and Pride of the North, a small early maturing sort. In the more recent efforts to fix the characteristics of the desired type the breeding-plat idea was adopted, the new seed being planted by itself away from other corn and all tassels of barren and otherwise undesirable stalks removed as soon as they appeared, to prevent them from producing pollen and fertilizing the future seed on the healthy and otherwise normal plants.

In animal breeding selection is comparatively easy and a pedigree record on both the male and female sides is readily established, but in plant breeding we meet with considerable difficulty in this connection. We can be absolutely certain of the male parent of an ear of corn only

when we have excluded all pollen from the mother plant and fertilized the blossoms with the pollen from a particular plant. It is possible to do this only with a few plants on account of the time required for the proper performance of the work, and on a larger scale it becomes impracticable. The only practical and the nearest possible solution of the problem is the use of the isolated breeding plat, in which only seed of known breeding is planted and in which all blossoms are naturally fertilized with pollen from plants of equal breeding, although it is impossible by this method to know the individual stalk or stalks furnishing the pollen for any particular ear or the stalk producing the pollen for any particular blossom or rudimentary grain. In this connection it may be pointed out that even in the breeding plat with its plants of equal breeding there may be three different relationships between the pollen and the blossom which it fertilizes, or, as we may say, three kinds of pollination are possible, namely, self-pollination, close-pollination, and cross-pollination. In self-pollination the pollen produced by a particular plant falls upon the silks and fertilizes the blossoms of the same plant. In close-pollination the pollen from a particular plant fertilizes the blossom of the plant grown from the same seed ear, i. e., the two plants have the same mother ear. In cross-pollination the pollen from the tassel of one plant fertilizes the blossoms of another plant grown from a different mother ear. Recent experiment-station work has brought forth a system of corn breeding in which inbreeding is practically entirely prevented. By this method self-pollination and close-pollination become impossible, and breeding between distantly related plants becomes merely a remote possibility.

The first lines of the experiment-station work with corn comprised variety tests of cultural factors, such as depth and time of plowing; time, manner, and depth of planting; distances between rows and intervals between plants in a row; depth, frequency, and manner of cultivation; and other problems. After considerable light had been thrown upon many of these questions, the improvement of corn by selection, and by breeding and selection, received more attention. This work was inaugurated and is still continued with a view to getting larger yields of shelled corn, rich in starch, oil, or protein, as the purpose for which the crop is intended may require. By their work the stations have shown the susceptibility of the corn plant to change in location of ears, quantity of leaves, and number of suckers, as well as to change in the composition of the grain and other characters. The increase in yield has, of course, received the most attention, and in this connection it has been shown how individual ears may differ in productivity, although of the same variety and produced under identical conditions.

REVIEW OF THE WORK DONE.

The principal object of corn breeding at the experiment stations is an increase in the yield of shelled corn per acre. The corn plant varies in height from 2 to 15 feet, according to variety and climate. The period of growth ranges from three to six and even seven months. The ear varies in shape, size, thickness of cob, percentage of grain, color of grain, and depth and width of kernel. The stalk varies in strength, leafiness, number and type of ears produced, position of ear, productivity, tendency to sucker, etc. These variations are all turned to account in corn breeding. The problem is to indicate how the variations may be best observed, how selection should be made, and how favorable characteristics which appear may be fixed and retained.

CROSS-POLLINATION.

Experiments in the improvement of corn by cross-fertilization have been carried on by several of the experiment stations, but this line of investigation seems to have been more prominent some years ago than it is now, the work in breeding being at present largely devoted to breeding on a larger scale, by methods applicable in a practical way by farmers.

Improvement by cross-pollination was carried on at the Kansas experiment station from 1888 to 1890, and numerous crosses thus secured were successful. The different races, such as dent, flint, soft, sweet, and pop corn, apparently crossed readily. In a comparatively few cases, generally in sweet-corn varieties, the effects of crossing were visible the first year. The second generation usually showed ears more or less completely blended and often exactly intermediate between the two parent types. More rarely the grains of a single ear were unlike each other, resembling closely or remotely one parent or the other. The third year the produce was generally true to the seed planted.

In 1891 some blue kernels, found on ears whose immediate parents were known to have shown no kernels of this color, were planted, and one of the resulting ears was fertilized with pollen from the same stalk. This ear contained 370 kernels, of which 206 were blue, 71 pink, 71 orange-yellow, and 22 pure white. Five other ears from the same seed exposed to the pollen of other varieties showed the same variation in color, with a slightly smaller percentage of blue. In studying the prepotency of the blue corn a large number of ears on other plats near by were examined, and it was found that about half the number of uninclosed ears had from 1 to 5 blue kernels, while of inclosed ears not one showed a trace of blue. This result also showed that inclosing the ears in closely woven cloth sacks is effective in keeping out foreign pollen.

Observations on the effects of cross-fertilization at the Iowa station have brought out the fact that the tassels and the silks of the upper primary ears generally appeared about the same time, and that the pollen of the upper central spikes of the tassels usually falls about twenty-four hours before that of the lateral spikes. The first silks protruding through the husk are from the lower end or butt of the ear, and the silks above them appear gradually until all are exposed, the time required for this process being usually from two to five days; but frequently the upper silks are not more than twenty-four hours later in appearing than the lower, and sometimes they are ten days later. It was found that usually twenty-four hours elapsed before the silks were in the receptive condition after their first appearance. When it takes four or five days for all the silks to appear, the lower grains of corn start their development before those farther up on the ear begin to grow and are, therefore, strong enough to rob the younger and weaker grains and to cause them to die from starvation. These conditions are considered the cause of the lack of proper filling at the point of the ear. But when the silks all appear within twenty-four hours or less, the ears develop simultaneously at both ends, making a properly filled ear from butt to tip. It is concluded from the observations made that the best corn for Iowa, when well grown, should not exceed 9½ feet in height, the ears being 3½ feet from the ground, and each stalk having 13 blades. In its early improvement work this station demonstrated the value of planting the corn in an isolated field for the purpose of carrying on breeding experiments, and the results obtained, together with the experience at other stations, suggested the idea of developing the breeding plat.

Work in corn improvement was begun at the Illinois station in 1889, crosses being made between varieties of dent corn and varieties of dent, sweet, and pop corn. In the crosses between varieties of dent corn of the same color or between varieties of sweet corn of the same color the change in the crossed ear could not with certainty be attributed to the influence of the pollen, the variations in these ears being apparently no greater than in those of the same variety left to form naturally. Ears produced by crossing white sweet corn with pollen of the yellow dent corn were nearly as dark as the male parent, with kernels very much like flint corn in appearance and with the taste characteristic of dent corn. Where both sweet and dent kernels appeared on the same ear the dent kernels were always the heavier. It was observed that color, where it is a character of the kernels and not of the seed coat, tends very strongly to pass from one variety to another. Crosses in which yellow dent corn was the male and sweet corn the female, yellow sweet the male and white sweet the female, and yellow pop corn the male and white dent the female, exhibited the greatest degree of success. On 19 ears produced by these various

crosses only 2 kernels did not show distinctly the effects of the pollen. Of sweet corn stalks bearing 2 ears, one crossed artificially and the other left to be naturally fertilized, there was no indication of anything but sweet corn on the naturally fertilized ears. All crosses except the pure dent corn crosses were planted, and during the first growing season the uniformity of the plats was very noticeable. The number of rows of kernels on the ear seemed to be modified about equally by each parent, and the number of ears to the stalk showed a tendency to follow the same type as the stalk. The ears from each of the crossed plats were as uniform as the commonest varieties of corn, and the crosses of different varieties showed the characters of each parent to about the same extent. The crosses between pop corn and dent corn seem to show the effect of the male more than of the female parent, while those of which pop corn was the male parent were more flinty than those in which the dent corn had furnished the pollen. The corn grown from the crossed seed was in nearly all cases increased in size as a result of the crossing.

The second year the corn continued to be comparatively uniform in type where the parent varieties were similar, but where they were different, as in the crosses between sweet and dent, the progeny tended strongly to run back to the parent forms, while at the same time taking on other forms different from either. Nearly all the corn grown the second year was smaller than that grown the first year, although most of it larger than that of the parent varieties. Some of the varieties which might be supposed to be most nearly related, as the sweet corns, showed very little increase when grown from crossed seed, while the two varieties of pop corn, which would seem as nearly related to each other as the varieties of sweet corn, gave a very decided increase in size when grown from crossed seed. Corn from the crosses of Black Mexican and White Dent, two widely different varieties, showed a decrease in size, while that from Flour corn and Golden Coin, varieties apparently as widely different as any crossed, gave ears showing the greatest proportionate gain in size. There seemed to be a strong tendency of the progeny of the different varieties of dent, sweet, and pop corn toward the flint type.

In 1892 in each of five cases the yield from plats of cross-bred corn was larger than the average yield of plats planted with varieties which had not been crossed, the average increase being more than 9 bushels per acre. In 1893 seed from cross-fertilized ears in every instance produced a larger yield and larger stalks than seed from self-fertilized ears, but the ears of the latter were more uniform in character. In 1893 in three out of four cases the yield from cross-bred seed was greater by 2.3 bushels per acre than the average yield of the parent varieties. In 1894 the seed from cross-fertilized plants selected in 1892 and 1893 gave an average increase of 12 bushels per acre over the parent varieties.

Of numerous crosses made by the Wisconsin experiment station, Wisconsin No. 8 corn on Toole North Star has given promise of the best results. The new variety appears to have a larger ear than the Wisconsin No. 8 and a shorter maturing period than the Toole North Star. In a culture test this variety was ripe for cutting September 26, 126 days after planting, while the preceding year Wisconsin No. 8 ripened in 120 days and Toole North Star in 133.

OBSERVATIONS ON THE MIXING OF CORN.

At the Minnesota station Mercer Yellow flint corn in proximity to Black Mexican sweet corn produced several black grains on some of the ears. A dozen of these dark-colored grains were planted and protected from pollen from other varieties. The ears produced showed that the Black Mexican corn had fertilized dark-colored grains on the ears of flint corn the preceding year. Besides the yellow flint and black sweet grains, there were white sweet and white flint grains on nearly every ear, which is taken as showing the ancestry of this cross. It is possible that both parents had been crossed with different varieties and that the different ancestral characteristics reappeared, and from these results the importance of keeping seed pure is evident.

The Rhode Island station planted Longfellow flint corn in close proximity to sweet corn, but the resulting ears failed to show any kernels of the sweet corn type on the ears of the flint corn, although the yellow kernels were very numerous on the sweet corn, being mostly found on ears taken from rows next the yellow corn.

CHANGING THE CHEMICAL COMPOSITION OF THE KERNEL BY BREEDING.

After cross-fertilization and its effects had been studied for a series of years, the efforts of the stations were turned toward the improvement of the chemical composition of the kernel. At the Illinois station this special study was begun in 1896, and the first results indicated that kernels of the same ear are much more uniform in chemical composition than different ears of the same variety, which often show a wide variation in this respect. Similar work at the Kansas station showed that in 33 varieties under investigation the nitrogen content ranged from 1.56 to 2.26 per cent; in different ears of a variety grown for thirty years it ranged from 1.53 to 2.24 per cent, and in ears of a cross originated the previous year from 1.35 to 2.22 per cent. In these tests the nitrogen content of single kernels from the same ear also showed variations, but not to so great an extent as among different ears of the same variety. It was also found that the specific gravity of kernels is too uncertain a factor for the selection of corn rich in nitrogen. Of the original 33 varieties,

21 were selected for breeding purposes, and for three years the crosses obtained showed remarkably high percentages of nitrogen in many cases. In 12 cases the average was about 2.40 per cent of nitrogen, or 15 per cent of protein.

Subsequent to the preliminary work above referred to, the Illinois station took up the work of breeding for high and low protein and high and low fat content in the kernel, and developed in this connection a method for the arrangement and the maintenance of a breeding plat. In six tests the shelled corn grown from seed selected for high and low protein and high and low fat content showed differences ranging in protein from 0.50 to 1.25 per cent and in fat content from 0.67 to 1.45 per cent. Investigations on the relation of the size of the kernel to the percentage of protein or fat showed that the weight of kernels from 24 ears high in protein averaged 0.372 gram per kernel, from 16 ears low in protein 0.337 gram per kernel; from 12 ears high in fat 0.345 gram, and from 16 ears low in fat 0.42 gram per kernel. In general, the tendency of corn high in fat content was toward small kernels and of corn low in fat content toward large kernels. It was also found that a high percentage of germ is correlated with a high fat content. These results seem to show that by proper selection of seed the protein, fat, or carbohydrates of corn may be increased or decreased.

Together with the chemical composition of the kernel its physical composition was also studied. The different parts which go to make up the physical composition of the kernel, as worked out by the Illinois station, are the tip-cap, hull, horny gluten, horny starch, white starch, and germ. The tip-cap covers the tip or base of the kernel, by which it is attached to the cob, and comprises about 1.5 per cent of the grain, and the hull is the very thin outer coat, constituting about 6 per cent of the kernel and containing a smaller percentage of protein than any other part of it. The horny gluten, lying immediately under the hull, comprises from 8 to 14 per cent of the grain, and is more abundant in the kernels with high protein content. It contains from 20 to 25 per cent of protein and is the richest in this substance of all the parts of the kernel. The horny starch is the chief substance in the sides and back of the kernel, making up about 45 per cent of ordinary corn. In high-protein corn the percentage of this substance is much higher and in low-protein corn much lower than 45 per cent. This part of the kernel is rich in starch and, while containing only about 10 per cent of protein, it furnishes a greater total amount than any other part, because it constitutes a larger proportion of the entire grain. The white starch, occupying the center of the crown end of the kernel and usually partially surrounding the germ, comprises about 25 per cent of the kernel, being less in high-protein corn and greater in low-protein corn. It contains only from

5 to 8 per cent of protein. The germ comprises about 11 per cent of the kernel and varies according to the oil content, constituting a higher proportion in high-oil corn and a smaller proportion in low-oil corn. In these investigations the oil in the germ ranged from 35 to 40 per cent and from 80 to 85 per cent of the total oil present. Corn high in protein contains a larger proportion of horny gluten and horny starch and a correspondingly smaller proportion of white starch. In corn of high protein content the horny parts constitute about 60 per cent of the kernel and contain about 80 per cent of the total protein.

Two strains of corn bred for four years for a high and a low oil content showed an average difference of 1.97 per cent in the oil content and 0.18 per cent in the protein content, or, in other words, a very high degree of correlation between oil and protein. It is concluded that as the percentage of protein increases the starch decreases and the oil content remains practically unchanged, and that the selection of high-protein seed corn should be governed by a high proportion of germ. In a study of four strains of pedigreed corn, the crop representing the seventh generation, the protein content of low-protein ears varied from 6.36 to 7.9 per cent, with an average of 6.71 per cent, while the protein content of the high-protein ears varied from 13.98 to 15.01 per cent, with an average of 14.44 per cent. The average oil content of the low-protein ears was 4.21 and of the high-protein ears 4.93 per cent. In a further test of the composition of the kernels a correlation between oil and protein was apparent only to a small degree, the high-oil corn containing nearly three times as much oil as the low-oil corn, but being less than one-seventh richer in protein. A very marked correlation between oil and germ was shown, the low-oil ears containing an average of 2.52 per cent of oil and 7.74 per cent of germ and the high-oil ears an average of 7 per cent of oil and 13.84 per cent of germ.

The effect of breeding in changing the composition of the different physical parts of the kernel is shown by the fact that the germs from the low-oil corn contained about 25 per cent of oil and those from the high-oil corn nearly 42 per cent, while the endosperms from the low-protein ears contained less than 6 per cent of protein and those from the high-protein ears nearly 14 per cent. Breeding for high or low protein produced no marked effect upon the ash content or the oil content of either the germs or the endosperms and only slightly influenced the protein content of the germs. As calculated on the basis of 100 pounds of corn, there was a maximum difference of only 0.75 pound of protein in the germs from 100 pounds of low-protein and high-protein corn and a difference of 7.06 pounds of protein in the endosperms.

At the North Dakota station corn selected for high nitrogen content in 1901 gave in most cases corn of high nitrogen content in 1902, but the crop of 1903 presented some marked variations. The physical method of selecting corn of a high nitrogen content was found quite reliable.

THE DEVELOPMENT OF THE BREEDING PLAT.

The development of the breeding plat and its introduction into practical corn breeding, aside from experimental work, mark an important step in the progress of corn improvement. The object of the breeding plat is to produce highly and purely bred seed and to enable the breeder to keep a record showing the breeding of every seed ear secured and the productive capacity of each individual ear planted in the plat. The principal purpose of its location, arrangement, and management is to prevent all foreign or outside pollen, as well as the pollen from diseased, poorly developed, or otherwise abnormal plants, from fertilizing the blossoms of the seed plants, and also to avoid self-pollination and close pollination within the plat. Corn, being a wind-pollinated plant, is with difficulty kept pure in breeding, and the first idea followed in establishing a breeding plat was to isolate it or to locate it at such a distance from other growing corn plats (a quarter of a mile if possible and preferably in the direction opposite to the prevailing winds) as to make it only a remote possibility that outside pollen would be carried into the plat by the wind and thus blossoms of one variety be fertilized with the pollen of another.

The fact that individual ears similar in appearance and scoring equally high may still show great differences in yields was early recognized, and led to establishing the performance record of each ear and the selection of seed from only those ears showing the greatest yielding power. The most practical, if not the only, method of comparing the productiveness of individual ears is the parallel-row system advocated by the stations generally. The first recommendation for the arranging of the breeding plat with these points in view made by the Illinois experiment station was to the effect that 40 selected ears be planted in 40 separate parallel rows, one ear to a row, the rows being long enough to require each about three-fourths of an ear for planting them. It was also advised to plant the very best seed ears in the middle rows, grading them uniformly to either side, so that the least desirable ears might be planted in the outside rows, and to shell the remainder of the corn from all of the 40 ears and use it for planting several rows entirely around the breeding plat to give additional protection, especially from foreign pollen. In this stage of its development the breeding plat gave a comparison of the different seed ears, showing their individuality, and by isolation reserved the fertilization

of the blossoms to the pollen produced within the plat. This arrangement, however, did not preclude either self or close pollination.

In the experience of the stations, removing the tassels from corn plants can truly be said to be of benefit only in breeding work, where it is applied in the prevention of self-pollination or the transfer of pollen from the tassel to the silks of the same plant. As demonstrated by the Illinois station, it is possible for inbreeding to take place in the field, because the plant sheds part of its pollen at a time when some of its own silk is already matured and in a receptive condition. In order to prevent inbreeding in connection with the parallel-row system of planting, this institution practices and recommends detaseling every other row before the pollen matures and selecting seed from the detasseled rows only. This makes sires of the plants in the tasseled rows and dams of those in the detasseled rows and positively prevents self-pollination. It also makes close pollination or the transfer of pollen from the tassel of one plant to the silks of another plant in the same row of dams impossible, so that the seed selected is entirely cross-bred. Even before the detasseling of the entire alternate rows was practiced by the station, all abnormal—especially barren and otherwise imperfect—plants were detasseled before their pollen matured in order to prevent the transmission of their undesirable characters.

The next step taken by the Illinois station in perfecting the breeding plat was to devise a method of planting which would give assurance that the seed of both sires and dams is cross-bred, and a practical commercial system insuring cross-breeding to the greatest possible extent was worked out. In studying the arrangement of the breeding plat up to this stage it may be seen that there still remains the possibility of introducing related blood, as the breeding is carried on from year to year, because the pedigree is established only on the female side, while it is impossible to tell just from what sire plant the pollen came which fertilized the flowers of any particular ear. As it is most likely that a row of dam plants is fertilized by the pollen of the rows of sires growing nearest to it, the station concluded that the breeding plat might be planted in such a way as to insure cross-breeding of plants not related to each other, or, at least, very remotely related. Based on this idea, and with this end in view, a mathematical arrangement of seed ears for planting was worked out and adopted.

SELECTION AS A FACTOR IN CORN IMPROVEMENT.

We have seen how artificial pollination may be employed in corn improvement, but it remains very evident that it is really only a small factor when compared with selection, upon which the great and general progress in corn breeding must be based, because crossing

without subsequent selection can accomplish but little, and for the further reason that selection is the more generally applicable of the two means. The farmer is already familiar with selection along a certain line and only a wider application of the principle is necessary. The endeavor of the experiment station and the agricultural college is to teach him how to apply it scientifically and practically, not only with reference to the ear, but also with reference to the kernel, the entire plant, and even the row.

Experiment-station work has brought about a marked change in the methods of selection. As already pointed out, the original method consisted in basing the selection upon the type of ear, and great progress in the improvement of corn has been thus accomplished, but experiments conducted by many stations have shown that even carefully selected seed ears, alike to all outward appearances, may still have a wide variation in yielding capacity, amounting to even more than 100 per cent. In fact, at the Nebraska station 10 seed ears compared for this purpose ranged in yield from 35.6 to 81.6 bushels, or a difference of 46 bushels per acre. The Wisconsin station in a recent test found the yields of different ears of Silver King corn to vary from 14 to 97 bushels of shelled corn per acre, and the yields of select seed ears from 1½ pounds to 56 pounds per ear of seed corn. The difference in productiveness is not revealed by an examination of the ears, but must be ascertained by actual test, so that the yields may be measured. This indeterminable factor is called the individuality and is analogous to the individuality in animals, which also shows itself in the progeny.

As in the development of the breeding plat, selection has gone through various stages. In some of the earlier work with corn the station efforts were largely directed toward testing and comparing varieties for the purpose of singling out those best suited to certain localities and conditions. This was selection applied to the variety as a whole, and as a typical instance some of the work of the Minnesota station may be cited. This station made a selection of varieties grown in the State and compared them. This collection was regarded as a foundation stock from which the best variety was to be selected. The varietal names, if any such existed, were disregarded and the samples received were simply indicated by a serial number. Of these varieties and strains No. 13 proved most promising, the distinguishing character being a high yielding capacity. The variety was tested for several years and selected according to scientific principles and then disseminated under the name of Minnesota No. 13. At present it is grown quite extensively in southern Minnesota and it has also been distributed in South Dakota by the experiment station of that State. The Wisconsin station has selected a strain of this variety, known as Wisconsin No. 8, the seed having been secured

from the Minnesota experiment station, and has used the same as the male parent in breeding for earlier maturity in some of the late heavy yielding varieties of yellow dent corn, in order to make them better suited to Wisconsin conditions. While this line of work is of the greatest value and must be carried on continuously, selection has been introduced to a much greater extent in procuring seed either for the improvement of the variety itself or for the maintenance of its desirable characters.

Formerly in seed-corn selection only the type of ear was considered, but it is now widely recognized, and the stations are continually dwelling upon the point, that this is not enough, but that selection must be applied to the individual plant and to the individual ear with reference to its productiveness. As shown by station work, it is the performance record rather than any particular point about the ear that forms a definite basis for the selection of its progeny for seed. Even the size of the ear, which undoubtedly was regarded as one of the principal and desirable features, and probably in most cases determined the selection of seed, can not be relied upon as indicating the best yielding qualities. In experiments to determine the relation of size of ear to yield the Nebraska station found that the average weight per ear of the five highest-yielding varieties under test was 0.705 pound, while the average weight per ear for all the varieties was much higher. In some cases large-eared varieties were rather low in yield, thus indicating that no definite relation between the size of the ear and the yielding capacity exists. It was further brought out by cooperative tests that the size of the yield varies with locality and is dependent upon soil, climate, and elevation, and the data secured showed plainly that for western and central Nebraska a smaller-eared type of corn should be selected than for the eastern portion of the State.

The effect and value of careful selection in corn growing are shown by the results of numerous other experiments and are especially and more definitely thrown into relief by cooperative work. In work of this kind by the Wisconsin Experiment Association in 1905 with Silver King corn, a variety which had undergone selection at the station for several years, an average yield of 59.2 bushels per acre was secured, while the best of all other not so long and carefully selected varieties observed in the comparison yielded on an average 10 bushels less.

At the Wisconsin experiment station the results of corn breeding in accordance with the plat system show an increase in the proportions and average yields of seed corn and marketable corn in the crops produced. In 1905 each row in the breeding plat produced on an average 22.6 pounds of seed corn, 97 pounds of marketable corn, and 7.2 pounds of nubbins, and in 1906, 53.1 pounds of seed corn, 132.8

pounds of marketable corn, and 13 pounds of nubbins. The average yield per acre of the plats in 1906 was at the rate of approximately 75 bushels per acre. The increase in yield was in some instances largely due to soil and season, but the increase in seed corn was greater in proportion than that of the nubbins, thus indicating that a constant selection from the breeding plat will materially increase productiveness and quality. An experiment was also made to determine to what extent the bearing qualities of different stalks would be transmitted to the progeny. Seed corn was selected from stalks bearing a single large ear and from stalks bearing two ears. A greater total yield was secured where the selection was made to increase the number of single ears in the plat than where it was made to increase the number of double ears. Where two ears were borne on a stalk generally one or both were small and poorly formed.

The Rhode Island station has pursued for several years a somewhat similar line of work with sweet corn by selecting the upper and lower ear of stalks producing the largest number of ears. This was done to ascertain whether the lower ear would increase lower-ear production, together with the number of ears on the stalk, as compared with seed from the upper ear. In 1901, 35 per cent of the plants bore more than one ear and in 1905, 90 per cent bore more than one ear, the highest number of ears from a single plant being 13. Although the earlier results seemed to show that the character or the individuality of the corn plant from which the seed is taken is of much greater importance in corn breeding than the position of the ear on the stalk, it was found that selecting seed from the lower ear was not so satisfactory as selecting it from the upper ear.

THE INFLUENCE OF THE WORK.

The corn-breeding work of the experiment stations has exerted a wide influence in all corn-growing sections of the country. Partly through the station publications and the agricultural press and partly through the activities of agricultural college extension forces, in cooperation with station workers, the farmers' institutes, the corn-growers' associations, and other similar factors, the results of this work are presented to the farmer and every effort is made to induce him to apply the principles demonstrated as advantageous and profitable. Every gathering at which the value of highly bred corn is discussed reflects the interest of the farming population in the subject and indicates the confidence placed in the station results and recommendations. Progress is most rapid when the individual farmer understands all the essential features of the work, but such a degree of efficiency is most readily reached through cooperation with the stations and such mutual assistance as the farmers themselves are able to give to each other.

Associations organized for the purpose of producing highly bred seed corn are doing good work in a number of States, prominent among them being Illinois, Iowa, Indiana, Kansas, Nebraska, and Missouri. In 1900, only about four years after the Illinois station inaugurated its corn-improvement work, the first seed-corn growers' organization, under the name of the Illinois Seed Corn Breeders' Association, was formed and the methods of corn breeding advised by the station were put into use throughout the State. As an example of different lines of endeavor of such associations the work of the Kansas Corn Breeders' Association may be cited. This organization endeavors to establish improved types and strains of corn meeting the needs of different sections of the State, to stimulate and to promote the growing of pure seed corn within the State, to furnish means by which valuable native strains showing purity of breeding may be recognized as pure bred, to establish a bureau of inspection with authority to give certificates of type and breeding for corn grown by breeders, to furnish information on seed corn to farmers and purchasers for their convenience and protection, to aid in enacting legislation protecting the grower of pure-bred seed corn, to establish a score card or standard of perfection for each recognized breed of corn, and to further in every way the interests of corn culture. Corn may be recognized as pure bred by a vote of the association when it has been bred and selected by itself for five years or more and the proper association authorities have inspected and examined the corn in the locality in which it is grown and have recommended to the association that such corn be recognized as a pure-bred corn. In addition to these stipulations the breeder is required to bring a bushel of selected ears of the particular variety to the meeting of the association in which the vote is cast and to give a detailed description, including the history of its breeding and its production.

Another plan of cooperation followed in some localities consists in the production of seed corn by one of a group of neighbors whose farm is suitably located and presents average soil conditions. This farmer plants the best variety for the locality, as previously determined, and grows a crop under approved methods of corn improvement and culture, with the understanding that the other parties to the agreement will buy the seed corn produced at a stipulated price. In the work of continuous improvement and the maintenance of a high standard of production throughout the entire country all associations of corn growers and corn breeders are a most important and helpful factor.

Our farm lands are steadily increasing in value, and in view of this condition, together with the fact that American agricultural labor should always be well paid, we must obtain greater yields from the same areas without very materially increasing the cost of production in order to get the proper return on the money invested in our farms. This result may be achieved in corn culture by the use of higher

and better bred varieties, as no greater expense is involved in growing a variety ranking high in yield and quality than in growing an inferior one.

The experiments showing the value of a full stand of healthy plants grown from strong and vigorous seed, the inquiries into the effects of detasseling, the observations on the mixing of different types and varieties, the investigations in crossing, the studies of the chemical composition of the kernel, and similar lines of work constitute the preliminary measures which led to the establishment of the breeding plat, with its superior facilities for comparing the yielding power of individual ears, insuring cross-pollination and pure breeding, and establishing a pedigree of seed ears. The data derived from all the different lines of corn improvement by the experiment stations have been systematically and scientifically grouped by these same institutions and are now presented to the farmer and the commercial seed-corn grower as a harmonious whole in the form of a complete and practical system of corn breeding for the improvement of the corn plant in both yield and quality and for the maintenance of a high standard of excellence.

NUTS AND THEIR USES AS FOOD.

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INTRODUCTION.

The constantly increasing consumption of nuts throughout the United States augurs well for a better appreciation of their food value. The time when nuts were considered merely as a luxury, or as something to be eaten out of hand at odd times, is rapidly passing away. In earlier days the native hickories, butternuts, walnuts, chestnuts, and many other nuts found in the United States were to be had in country regions for the gathering and were of no commercial importance. On the other hand, the English walnuts (to give them their most common name), almonds, cocoanuts, etc., brought from other countries, were relatively expensive luxuries. Conditions have materially changed and our principal native nuts are now staple market commodities and bring good prices. At the same time, owing to changes in market conditions, the price of the imported nuts has dropped so that they are well within the reach of the majority.

Some nuts, like the native hazelnut and beechnut, have practically no commercial value and, though palatable, are almost never offered for sale, doubtless because they are so small and difficult to gather in quantity. The chinquapin, a small nut allied to the chestnut, finds a limited sale in southern cities, but is seldom seen in other markets.

From available statistics it appears that in 1905 the total quantity of almonds, cocoanuts, Brazil nuts, filberts, peanuts, walnuts, and other nuts, shelled and unshelled, imported into the United States was, in round numbers, 86,238,000 pounds, with a value of $6,138,000. In 1905 the total almond crop in California reached 4,200,000 pounds and the walnut crop 12,800,000 pounds. The richest yield of peanuts was reported from the Southern States, chiefly Virginia, Georgia, and Tennessee, and amounted to 225,000,000 pounds.

The total quantity of home-grown nuts, including both native and cultivated varieties, must far exceed the quantities imported, but in the nature of the case no estimates of the total quantities gathered and eaten are procurable. When we consider the constantly increasing demand for nuts and the large quantity which we import the possibilities of the industry for the American nut grower are obvious.

As the use of nuts has increased, many persons have turned their attention to the growing of native and foreign nuts on a commercial

scale. This work has been forwarded by the Department of Agriculture, through the Bureau of Plant Industry, and by the California, Florida, Michigan, and other agricultural experiment stations. With nuts, as with other crops, it has been found that, by selection and breeding, improved varieties are obtainable, of larger size, better flavor, thinner shells, or other desirable characteristics. The increased demand for nuts is due in the main to two causes, namely, a better appreciation of their appetizing qualities and the numerous ways in which they form a palatable addition to the diet of the average family, and, secondly, to their use by the vegetarians and persons of similar belief—a group small in proportion to the total population, but still fairly large numerically—who use nuts, and more particularly the peanut, as a substitute for meat and other nitrogenous and fatty foods.

Many special nut foods, such as malted nuts, meat substitutes, etc., have been devised and extensively advertised by the manufacturers for general use in the diet and for the special needs of vegetarians and fruitarians. It is said that some of these American nut products contain soy beans, but apparently the peanut plays a very important part in their composition. In either case, since the peanut, like the soy bean, is a legume, these preparations might more properly be compared with the bean cheese and other soy-bean products so much used in China, Japan, and other eastern countries than with such nuts as the walnut, almond, or cocoanut.

DESCRIPTION OF NUTS.

The term "nut" is not a definite one botanically speaking, but is applied indiscriminately to a variety of certain fruits or parts of fruits and implies a more or less hard, woody covering surrounding a meat or kernel. The most diverse plant groups contribute to our nut supply, many of the nuts being the product of our beech, chestnut, walnut, and other deciduous trees and bushes, some of pines and tropical palms, and others, like the peanut and pistache or pistachio, being the fruit, respectively, of a vine-like plant and a small tree, both belonging to the family of legumes. Still another, the water chestnut, is supplied by a water plant.

Most of the native and foreign nuts which we use are too familiar to need description. Several, however, are not so generally known.

Pinenuts, which grow in the cones of a number of varieties of native and foreign pines, are now fairly common in our markets. The Indians have always known and appreciated them and have passed on their knowledge to the white race. Then, too, many immigrants who came to this country knew the pinenut, for it has long been much eaten in Italy and other parts of southern Europe, where there are a number of nut-yielding pines. The small, rather pointed white nuts

are usually marketed shelled, but as they grow are covered with a more or less hard, woody shell. The pistache nut (now grown in California) has long been used and is prized by confectioners for its delicate flavor and attractive green color, yet it is by no means common. The nuts are small, not unlike a bean in size and shape, though more pointed, and before marketing are freed from the pods in which they grow. The individual nuts are covered with a gray or purplish skin, and are blanched before they are used.

The so-called lichi nut, which is really a dried fruit surrounded by a nut-like shell and not unlike a raisin in flavor, is a favorite in China and has become quite common in this country. The ginkgo nut, the fruit of an ornamental tree quite widely grown in the United States and sometimes called the maidenhair tree from the shape of the leaves, and which fruits abundantly in some regions, is seldom eaten except by the Chinese, who gather it whenever possible. The small, roundish, oval, thin-shelled nut is surrounded by a very acrid, bad-smelling pulp, the whole fruit being not unlike a green damson plum in size and appearance. In China, Korea, and other parts of the Orient this nut is much used as a food, and, so far as can be learned, is always cooked in some way. Roasted like a peanut, it is palatable. The ginkgo nuts are on sale in the Chinese shops in San Francisco and doubtless in other cities, and were studied at the California experiment station some years ago, together with other Chinese foods.

The water chestnut, or horn chestnut (*Trapa bispinosa*), an aquatic plant, produces a seed or "nut" which somewhat resembles two curved horns united in one, the kernel of which is largely used as a food by the inhabitants of Asiatic countries. This so-called nut is also on sale in the United States, but chiefly in Chinese shops. Another water plant (*Eleocharis tuberosa*) is also known as the water chestnut, but in this case it is the corm or bulb that is eaten. It is not unlike a chestnut in shape, and has a tough, brown skin. This is grown in Asia, but is imported by the Chinese in this country. A three-cornered pointed nut or seed, the pit of the Chinese olive (*Canarium* sp.), is also on sale at Chinese shops in the United States. The kernels are oily but palatable, and are used in Java for making a nut milk much thought of for infant feeding.

The chufa, nut grass, or earth almond is a small tuberous root of a sedgelike plant and perhaps should be classed with the vegetables rather than with nuts. It is not common, though sometimes eaten.

From time to time new nuts make their appearance on the market as some nut prized locally becomes known to the trade. A nut which seems to be growing in popularity, though still uncommon, is the Paradise nut of South America, which resembles a Brazil nut in appearance and flavor. Still less common is the South African cream nut,

though it is sometimes shipped to this country. The choicest member of the Brazil-nut group is the true "butternut" of the Tropics, which is very seldom found outside that region. Its flavor is very delicate and delicious, but it does not keep well; and even if it would bear shipment successfully, the available supply is at present very small. The cashew nut of tropical regions, which many consider one of the most delicious nuts grown, has long been known, but has never become common. It is sold to some extent and brings high prices. This nut is roasted before it is eaten, as the raw nut contains poisonous properties which are readily destroyed by heat.

The oval, flat, and rather large seeds of a pumpkin-like fruit, tabebuia (*Telfairia pedata*), from Zanzibar, which has been grown in a limited way at the Porto Rico experiment station, are roasted and eaten like a nut. The flavor is oily and fairly palatable. This suggests the use in Russia of the raw sunflower seed, which is rich in oil and not unlike some of the common nuts in composition. The seeds are eaten out of hand at all times and by all classes.

THE FLAVOR OF NUTS.

The flavor of nuts is very largely dependent upon the oils which they contain, though in some there are also specific flavoring bodies. The nut oils readily become rancid, the very disagreeable flavor of spoiled nuts being due to this property. Some nuts, for instance, the chestnut, have a starchy flavor as well as a "nutty" taste. The small native nut is much more highly flavored than the large Italian or the Japanese chestnut. The almond possesses the cyanic-acid flavor, which is characteristic of peach pits, plum pits, etc., and this might be expected when it is remembered that the almond is the dried pit of an inedible fruit somewhat resembling the peach in appearance and closely related to it botanically. Most almonds are mild flavored, though in the so-called bitter almonds the cyanic-acid yielding glucosid is more abundant. In raw peanuts there is a decided flavor resembling that of the closely related beans and peas, and to some persons this is not unpalatable. In the roasted peanut, which most of us prefer to the raw, the flavor is largely dependent upon the browned oils and starches or other carbohydrates.

COMPOSITION OF NUTS.

The composition of nuts and nut products has been studied at a number of the agricultural experiment stations, notably California, Maine, and Iowa, and the table on the following page summarizes the results of this work, the American data being supplemented in a number of cases by the results of European analyses. For purposes of comparison several other common food materials are also included.

Average composition of nuts and nut products.

Kind of food.	Refuse.	Edible portion.						
		Water.	Protein.	Fat.	Carbohydrates.		Ash.	Fuel value per pound.
					Sugar, starch, etc.	Crude fiber.		
Nuts and nut products:	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Acorn, fresh	17.80	34.7	4.4	4.7	50.4	4.2	1.6	1,265
Almond	47.00	4.9	21.4	54.4	13.8	3.0	2.5	2,895
Beechnut	36.90	6.6	21.8	49.9	18.0		3.7	2,740
Brazil nut	49.35	4.7	17.4	65.0	5.7	3.9	3.3	3,120
Butternut	86.40	4.5	27.9	61.2	3.4		3.0	3,370
Candle nut	....	5.9	21.4	61.7	4.9	2.8	3.3	3,020
Chestnut, fresh	15.70	43.4	6.4	6.0	41.3	1.5	1.4	1,140
Chestnut, dry	23.40	6.1	10.7	7.8	70.1	2.9	2.4	1,840
Horn chestnut or water chestnut	....	10.6	10.9	.7	73.8	1.4	2.6	1,540
Chufa (earth almond)	....	2.2	3.5	31.6	50.2	10.5	2.0	2,435
Cocoanut	34.66	13.0	6.6	56.2	13.7	8.9	1.6	2,805
Filbert	52.08	5.4	16.5	64.0	11.7		2.4	3,100
Ginkgo nut (seeds)	....	47.3	5.9	.8	43.1	.9	2.0	940
Hickory nut	62.20	3.7	15.4	67.4	11.4		2.1	3,345
Lichi nut	41.60	16.4	2.9	.8	78.0		1.9	1,510
Paradise nut	45.70	2.3	22.2	62.6	10.2		2.7	3,380
Peanut	27.04	7.4	29.8	43.5	14.7	2.4	2.2	2,610
Pecan	50.10	3.4	12.1	70.7	8.5	3.7	1.6	3,300
Pignolia (shelled)	....	6.2	33.9	48.2	6.5	1.4	3.8	2,710
Pistachio	....	4.2	22.6	54.5	15.6		3.1	3,250
Walnut	58.80	3.4	18.2	60.7	13.7	2.3	1.7	3,075
Almond butter	....	2.2	21.7	61.5	11.6		3.0	3,340
Almond paste	....	24.2	13.1	23.9	29.4	7.8	1.6	1,900
Peanut butter	....	2.1	29.3	46.5	17.1		5.0	2,825
Malted nuts	....	2.6	23.7	27.6	43.9		2.2	2,600
Cocoanut candy	....	3.9	2.4	11.9	76.7	4.5	.6	2,000
Peanut candy	....	3.0	10.3	16.6	66.9	2.1	1.1	2,115
Chestnuts, preserved (marron glacé), air dried	....	18.2	1.3	.5	79.7		.3	1,530
Walnuts preserved in sirup, air dried	....	16.9	13.6	20.0	48.6		.9	2,780
Cocoanut milk	....	92.7	.4	1.5	4.6		.8	155
Cocoanut, desiccated	....	3.5	6.3	57.4	31.5		1.3	3,125
Peanut coffee made from entire kernel	....	5.1	27.9	50.1	12.3	2.4	2.2	2,805
Chestnut flour	....	7.8	4.6	3.4	80.8		3.4	1,780
Cocoanut flour	....	14.4	20.6	2.1	45.9	10.1	6.9	1,480
Hazelnut meal	....	2.7	11.7	65.6	17.8		2.2	3,185
Other foods for comparison:								
Meat, round steak	....	65.5	19.8	13.6	....	....	1.1	950
Cheese, cheddar	....	27.4	27.7	36.8	4.1	....	4.0	2,145
Eggs, boiled	11.20	65.0	12.4	10.7	....	....	.7	680
Wheat flour, high grade	....	12.0	11.4	1.0	74.8	.3	.5	1,650
White bread	....	35.3	9.2	1.3	52.6	.5	1.1	1,215
Beans, dried	....	12.6	22.5	1.8	55.2	4.4	3.5	1,605
Potatoes	20.00	78.3	2.2	.1	18.0	.4	1.0	385
Apples	25.00	84.6	.4	.5	13.0	1.2	.3	290
Raisins	10.00	14.6	2.6	3.3	73.6	2.5	3.4	1,605

Refuse, mostly shell, constitutes a considerable proportion of the nuts as purchased, varying greatly with the different kinds. With fresh chestnuts the proportion is nearly 16 per cent, peanuts 27 per cent, almonds 47 per cent, and butternuts 86 per cent.

The edible portion of nuts, with few exceptions, is very concentrated food, containing little water and much fat. In general, nuts are also rich in protein. Those ranking highest in this nutrient, the pignolia, a variety of pinenut imported from Spain, with 33.9 per cent, the peanut with 29.8 per cent, and the butternut with 27.9 per cent protein, surpass most ordinary animal or vegetable foods in this respect. The almond, beechnut, and pistachio, with 21.4 per cent, 21.8 per cent, and 22.6 per cent, respectively, compare favorably with dried legumes. The Brazil nut contains 17.4 per cent protein, the filbert 16.5 per cent, the walnut 18.2 per cent, the hickory nut 15.4 per cent, the pinenut 14.8 per cent, the pecan 12.1 per cent, and the dry chestnut but 10.7 per cent. The dry acorn, fresh chestnut, and cocoanut, with, respectively, 6.4, 6.4, and 6.6 per cent, are not as rich in protein as bread.

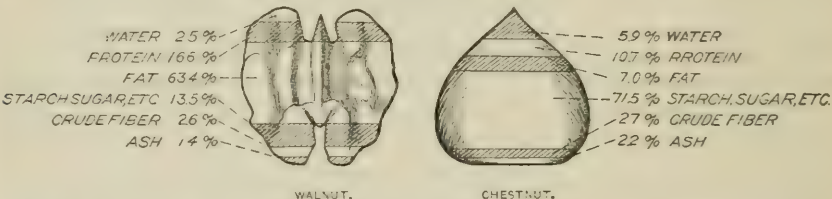

FIG. 8.—Percentage composition of an oily nut (walnut) and a starchy nut (chestnut).

Of the nuts here included the richest in fat is the pecan, with an average of 70.7 per cent, but 7 other varieties—the Brazil nut, butternut, candlenut, filbert, hickory nut, pinenut, and walnut—contain upward of 60 per cent. The almond, cocoanut, and pistachio yield between 50 and 60 per cent of this nutrient. The beechnut, peanut, and pignolia contain about 50 per cent. In other words, in 13 of the varieties of nuts appearing in the foregoing table, half or more of the edible portion is fat or oil.

Only a few of the commonly used nuts yield any notable amounts of total carbohydrate matter, the dry chestnut, with 73 per cent, rating highest. Beechnuts, pinenuts, and peanuts have about 18 per cent. The quantity of starch found is, with some exceptions, quite small, ranging from 3 per cent in the beechnut to 27 per cent in the chestnut.

Figure 8 shows in diagrammatic form the percentage composition of an oily nut, the walnut, and a starchy nut, the chestnut.

Nuts are, comparatively speaking, well supplied with mineral matter, this constituent in the majority of nuts exceeding 2 per cent. The ash of the walnut, almond, etc., is rich in phosphoric acid, and

in this regard compares favorably with that of cereals. It would appear from the data on the digestibility of nuts that the mineral matter is as well assimilated as that from other common foods.

DIGESTIBILITY OF NUTS.

With the exception, perhaps, of dried beans and cheese, no food material has the reputation for indigestibility that has been accorded to nuts. Discomfort from them is largely due to insufficient mastication and to the fact that nuts are often eaten when not needed, as after a hearty meal or late at night, though it is undoubtedly true that nut protein as ordinarily eaten is not so easily or so completely digested as meat protein. Very likely the concentration of nuts, with but 3 to 5 per cent water, as compared with meats containing from 50 to 70 per cent water, is a contributing cause. If careful consideration were given to this matter and if attention were paid to the proper use of nuts and their correct place in the diet, there would be less unfavorable comment on their digestibility.

The results of investigations carried on with fruit and nut diets at the California Agricultural Experiment Station afford tentative conclusions regarding thoroughness of digestion which should be of value to those who wish to use nuts as a staple article of food rather than as an occasional article of diet. This work has comprised 15 dietary studies and about 100 digestion experiments with elderly men, young men, women, and children, of whom some had been vegetarians for years, and some had even limited their diet almost exclusively to fruit and nuts; others had previously lived on the usual mixed diet. The average coefficients of digestibility reported for 28 experiments with 2 men and 1 woman were: Protein, 90 per cent; fat, 85 per cent; sugar, starch, etc., 96 per cent; crude fiber, 54 per cent; and ash, 68 per cent, with 86 per cent of the energy available. The corresponding figures for three experiments with the same subjects in which no fruit or nuts were used are: Protein, 94 per cent; fat, 92 per cent; sugar, starch, etc., 96 per cent; crude fiber, 49 per cent, with 88 per cent of the energy available. The latter coefficients agree very closely with those in the average of nearly 500 experiments with different sorts of mixed diet, namely: Protein, 92 per cent; fat, 95 per cent; and carbohydrates, 97 per cent. In view of these facts regarding composition and digestibility of their diet, it is evident that nuts must be regarded as the main source of protein for the fruitarians. The studies with fruitarians have all indicated that nut protein is fairly well assimilated; and that this is true with the average healthy person is well illustrated by an experiment with a university student, who, though entirely unaccustomed to such fare, gradually changed from an ordinary mixed diet to one of fruit and nuts, which he followed for a time without apparent loss of health or strength.

It is somewhat difficult to arrive at definite conclusions regarding the actual percentage of nut protein digested or assimilated. The experimental data obtained at the California station show a range of 75 to 82 per cent digestible protein when fruit and nuts were eaten together, but the figure for nut protein is doubtless higher. These coefficients were in all probability influenced by the fruit protein, which has been found to be less digestible than the nut protein. The digestibility of protein in 28 experiments with mixed diets, to which were added fruit and nuts, averaged 90 per cent.

As fruits, with the exception of the avocado and olive, yield only a small amount of fat, the fat which is contained in a fruitarian diet must be very largely obtained from the nuts. The average coefficients of digestibility for this nutrient in 30 experiments with men on a diet of fruit and nuts was 86 per cent, and in the 28 experiments just referred to it was 85 per cent. These figures are about 10 per cent lower than the average coefficient for digestibility of fats in the ordinary mixed diet. The digestibility of the carbohydrates in nuts, so far as the available data show, is about equal to that of the same ingredients in other foods.

So far as can be ascertained no experiments have been made on the ease or rapidity of digestion of nuts. In the absence of such data it is fair to assume that within reasonable limits the finer the state of subdivision of the food material, the easier, the more rapid, and perhaps the more nearly complete will be the digestion or assimilation, presupposing, of course, that the nuts are not eaten in addition to a hearty meal. Too much stress can not be laid on the necessity of thorough mastication of nuts. This is emphasized by the results obtained with one of the subjects at the California station, who ate largely of nuts but did not properly masticate his food. The coefficients of digestibility of the food were far lower than for other subjects who chewed their food thoroughly. The experiments with fruit and nut diets in general indicate that nut protein is as easily, even if not quite so completely, digested as protein from bread and milk.

The present discussion refers only to the nuts included in the studies at the California station, viz, the almond, Brazil nut, cocoanut, peanut, pecan, pignolia, and walnut. It is believed that these are typical of the ordinary edible nuts, but further digestion experiments are much needed for the purpose of testing some other nuts.

As regards the work of other investigators, both Memmo[a] and Merrill[b] report experiments with cooked chestnuts. Memmo's subject was a farm laborer, 53 years old, working eight hours a day. The experiment lasted four days. During the first two the food consisted exclusively of chestnut products. This was modified during

[a] Ann. Inst. Ig. Sper. Univ. Roma, n. s., 4 (1894), p. 263.

[b] Maine Sta. Bul. 131, p. 146.

the last two days by the addition of herring and cheese. In this experiment 75 per cent of the protein, 87 per cent of the fat, 97 per cent of the total carbohydrates, and 83 per cent of the ash were assimilated. The last figure is high; the others correspond to those reported for the California experiments with a fruit and nut diet.

The subjects of Merrill's experiments were two men aged 23 and 34 years, respectively. A mixed diet was used. Each subject consumed daily 300 grams of cooked chestnut flour, which furnished about 20 per cent of the proteids, 50 per cent of the fat, nearly 50 per cent of the carbohydrates, and not far from 40 per cent of the total fuel value of the food. The average digestion coefficients obtained for chestnuts with the two subjects were protein 56 per cent, fat 63 per cent, and total carbohydrates 98 per cent, while 89 per cent of the energy was available. Memmo also studied a kind of acorn bread eaten in Italy, and found it was fairly well assimilated, though not very palatable. Saiki[a] found that starch of raw Italian chestnuts was relatively indigestible.

It would appear, then, that, while it is not possible to state the exact digestion coefficients for all nuts, enough has been done to indicate their high nutritive value and digestibility.

PLACE OF NUTS IN THE DIET.

It has been shown by numerous investigations that nuts are rich in protein and fat and that these nutrients can be fairly well assimilated. Nuts being such a concentrated food, their proper place in the diet is a matter for more careful consideration than is the case with many of our ordinary food materials. It must not be forgotten that a certain bulkiness of the diet is conducive to its normal assimilation, and that too concentrated nutriment is often the cause of digestive disturbances. It might be expected, then, that nuts could be most advantageously used in connection with more bulky foods, such as fruits, vegetables, breads, crackers, etc. Most rationally used, they should constitute an integral part of the menu rather than supplement an already abundant meal. Since nuts are so concentrated, eating a considerable quantity out of hand at odd times will mean an oversupply of food if a corresponding reduction is not made in other foods. The distress sometimes experienced when nuts are eaten is undoubtedly often due to improper mastication or to overindulgence. The investigations made at the California station indicate clearly that considerable quantities of nuts properly eaten do not cause distress. There is a popular belief that a little salt with nuts prevents the digestive disturbance resulting from eating them. To most persons, salt undoubtedly adds to the palatability of the nuts, but no investigations have been found on record which demonstrate any actual improvement in the digestibility of nuts due to salt.

[a] Jour. Biol., 2 (1906), p. 251.

Nuts may be readily used as staple articles of diet, as an ingredient in salads and in soups, as a stuffing for poultry, in the making of desserts, and in many other ways. Wild turkey stuffed with pecan nuts is a dish popular with old Virginia cooks, just as goose stuffed with chestnuts is prized in Germany. Salted nuts and nuts crystallized in sugar are very common accompaniments of other foods. In general, the nuts rich in protein and fat should be used in combination with carbohydrate foods, as bread, fruit, green vegetables, etc., while such nuts as the chestnut, which do not contain much protein or fat, but are rich in carbohydrates, may be properly combined with meats, milk and cream, eggs, and other foods containing protein and fat.

Since nuts are relished by most persons, are nutritious, and may be readily used by themselves and in various palatable combinations as an integral part of the diet, they have a legitimate place in the menu. Those who, for any reason, wish to live on vegetable foods and dairy products or any form of vegetarian or fruitarian diet will almost inevitably look to nuts, particularly such as the peanut, for a considerable proportion of their total nutritive material. A fruit and nut diet may be arranged to furnish sufficient protein, mainly from nuts, to satisfy the requirements of the body, but the consensus of opinion of well-informed physiologists seems to be that such a diet is not generally advisable nor to be recommended for the majority of mankind in place of the more usual mixed diet. It should also be remembered that numerous experiments have shown that the protein from mixed diet has a higher coefficient of digestibility than nut protein, which indicates that the protein of nuts is the less economically utilized by the body. The argument which is so often advanced that primitive man lived on nuts and fruits exclusively and hence his descendants should do so, is not generally accepted.

The comparatively high price of many of the edible nuts, particularly when shelled, and the difficulty of cracking some varieties—like pecans, black walnuts, and hickory nuts—and extracting the kernels at home, greatly militate against the freer use of nuts in the household. The consumption of peanuts and English walnuts is perhaps increasing faster than that of some other nuts; but, whatever sort is selected, they should, as already noted, form a part of the diet and not supplement an already sufficient meal.

NUT BUTTERS.

Within the last few years so-called nut butters have been used in increasingly large amounts, and at least one variety, namely, peanut butter, is made and sold in ton lots. It has already been stated that in order to insure the best physiological results from the dietetic use of nuts they should be thoroughly ground up by the teeth and that, other things being equal, the digestion coefficient will vary directly

with the fineness of division. The nut butters, made as they are from the finely ground nuts with or without the addition of some water, oil, and salt, have a homogeneous consistency not unlike true butter, and when properly made the material is so finely divided that even if it is not thoroughly chewed it will presumably offer much less resistance to the digestive juices than nuts hastily eaten. Nuts, and hence nut butters, are very rich in fat which readily becomes rancid and unpalatable. This is doubtless one of the reasons why nut butters are quite commonly marketed in jars, etc., containing small amounts which may be utilized in a short time. The nut butters are recommended by vegetarians as a substitute for butter in culinary processes and for use at the table. With persons who are not vegetarians they are commonly used for making sandwiches and in other ways for their agreeable flavor and for the pleasing variety which they give the diet.

Nut butter may be easily made at home. The nuts may be pounded in a mortar, but a mill for grinding them is much more convenient and may be readily procured, as there are a number of sorts on the market. The process of making nut butters has been frequently described in journals and cookery books. Either the raw or the roasted peanut may be used for making peanut butter, but the roasted nut is the more satisfactory. The kernels should be freed from chaff and reduced to a paste in the grinding mill. Freshly roasted nuts are necessary, as those which have stood for a day or so after roasting lose in crispness, do not grind well, and tend to clog the mill. Any sort of nut may be used, but experience has shown that it is more difficult to make butters from the almond or Brazil nut than from the peanut. Blanching these nuts requires considerably more time and labor than is needed to free the peanut from the skin which covers the kernel, and they are also more difficult to grind. Nut butters will keep well if sealed in glass or earthenware jars. Tin cans also may be used, but are not quite as desirable. As might be expected, nut butters do not differ materially in composition from the nuts from which they are ground. (See table, p. 299.)

The nut butters just mentioned are entirely different from cocoanut butter and from cocoa butter, which are expressed and purified fats. These "butters" are of considerable commercial importance and are used for culinary purposes, though perhaps they are more commonly used in other ways.

NUT PASTES AND NUT PRESERVES.

Pastes which are used by confectioners for candy making and in other ways are made from nuts with the addition of sugar. Sometimes water and starch are added, but such admixtures are inferior to the nut and sugar pastes. The most common material of this

sort is the almond paste, which is manufactured in large quantities in the United States and is also imported. It is used for making cakes, candies, etc., the highly ornamented cakes called "marzipan," so popular with the Germans, being one of the very well-known almond-paste confections.

Chestnuts preserved or candied in sirup and then dried, the marron glacé of the confectioners, are esteemed a delicacy and are eaten alone or are used in confectionery, etc. Thus prepared, they are a common commercial article. Much less common are the English walnut meats in sirup, which are manufactured in Europe and exported to this country in limited quantities. In the Tropics a thick, sweet preserve is made from cocoanut and sugar which is much liked locally, though those who are not familiar with it consider it very sweet and insipid. As the data in the table on page 299 show, these products are rich in carbohydrates, owing to the added sugar.

NUT FLOURS AND MEALS.

Among nut products may be mentioned nut flours and meals. Some of these are used in large quantities and are made on a commercial scale, while others, perhaps owing to the trouble and expense incidental to manufacture, find only a limited use. In general, meals are made from the ordinary edible nuts by blanching, thoroughly drying, and grinding. By using a nut mill such meals may be ground at home. Analyses of some products of this character will be found in the table on page 299. Almond meal has been on the market for a long time, being used as food for diabetics and for making cakes, etc., as well as in a number of technical ways.

Special mention should be made of chestnut flour, which is on sale in the United States and is used for most of the culinary purposes for which the fresh nut is recommended. In Italy it constitutes a considerable part of the diet, in some regions being extensively used for making a sort of bread or cake. One of the most complete studies of the dietetic use of chestnuts has been reported by Memmo.[a] According to the author, the chestnut often serves almost as the exclusive food of the peasants of Tuscany for a considerable part of the year. The whole nuts are eaten in a variety of ways; for instance, boiled in water without hulling, hulled and boiled, or roasted. From the flour various cakes and other foods are made. Acorn meal made into a sort of bread with the addition of about 75 per cent of flour is a common article of diet in several regions, notably Umbria and Tuscany, but the bread is black and heavy and not very palatable.

The early travelers and explorers make mention of the extended use of nuts by the American Indians, and the custom of using acorns

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[a] Loc. cit.; see also p. 302.

FIG. 1.—CALIFORNIA INDIANS POUNDING ACORN MEAL FOR FOOD.

FIG. 2.—CALIFORNIA INDIAN LEACHING ACORNS FOR FOOD.

as a staple food is still kept up. The methods of preparing acorns followed by the Indians of northern California have been described by P. E. Goddard[a] in a publication of the University of California, and by V. K. Chesnut,[b] formerly of the Department of Agriculture. Briefly speaking, the shelled nuts are split, dried, and ground with a mortar and pestle. The sifted flour is placed in a hollow in the sand on a convenient river bank and leached to free it from the bitter principles present. From the leached meal a porridge or mush is made, which to the ordinary palate is much improved by the addition of salt. Plate XV shows the way in which the nuts are pounded into flour, and also shows an Indian woman leaching the meal. These typical Indian foods, when well prepared, are relished by many persons who have tried them, and it seems not improbable that improved methods of removing the tannin and bitter principles present in most varieties of acorns might result in the utilization of the acorn crop, which is fairly large and is generally wasted.

According to Chesnut's[c] investigations, the California buckeye or horse-chestnut is also used by the Indians as a food and is leached to free it from poisonous or objectionable matters in much the same way as the acorn. Many attempts have been made in Europe and elsewhere to treat the fruit of the common horse-chestnut in some way so that it might be made wholesome and palatable, for it undoubtedly contains an abundance of nutritive material, particularly starch; but none of these attempts has been really successful.

The use of partly extracted peanuts and other nut meals with wheat and rye flour for bread making should be mentioned. Such breads have been used for patients with diabetes, but have never come into general use, perhaps because they are not very palatable, since the nuts become rancid so readily.

NUT CANDIES.

One of the most extensive uses of nuts is in the manufacture of candy of various sorts, such as sugared almonds, burnt almonds, nut chocolates, caramels, pinoche, nut brittle, etc. While there are some differences in the process of manufacture followed in these candies, they all in the main consist of nuts and sugar in varying proportions, with flavoring extracts, and in some instances butter and flour.

The table on page 299 shows the composition of common sorts of nut candy. As may be seen, the water content is low and these candies are highly concentrated foods. On account of the added sugar the carbohydrate content is high. The proportion of nuts used in candies varies. By assuming that the nuts furnish the bulk of the fat

[a] Univ. Cal. Pubs., Amer. Arch. and Ethnol., 1 (1903), No. 1, p. 27.
[b] U. S. Dept. Agr., Div. Bot., Contrib. Nat. Herbarium, 7 (1902), p. 333.
[c] Loc. cit., p. 366.

in the candy, it is estimated that nuts constituted about 50 per cent in the specimens analyzed. It is perhaps well to suggest that nut candies and other candies which sometimes cause digestive disturbances would be more satisfactory if eaten in a rational way and at the proper time. Since they are concentrated foods, they should naturally replace an equivalent amount of some other food material and not be eaten in quantity simply for their palatable flavor in addition to an otherwise adequate daily ration.

NUT COFFEES.

A number of coffee substitutes made from nuts have been devised and placed on the market, peanut coffee and acorn coffee being by far the most common. The nuts are parched and sometimes otherwise treated. Such coffee substitutes lack the stimulating properties of true coffee, and the infusion does not have the high nutritive value which is sometimes claimed for it.

GREEN NUTS.

A number of kinds of nuts are used before they are fully ripe, and are esteemed a delicacy. In California in spring the markets quite commonly offer green almonds—that is, the almond picked from the tree while the husk is of a decided green color and easily separated from the soft and immature shell. The kernel, after the skin is peeled off, is eaten with or without salt, and is relished by many persons. The price of green almonds in California markets commonly varies from about 20 to 35 cents per pound. Green almonds are found to a limited extent in fancy fruit shops in eastern cities and elsewhere, and are perhaps purchased as much for their ornamental appearance as for their palatability. They are much more commonly used in Europe than in the United States. Green English walnuts and green hazelnuts are also eaten to a considerable extent in Europe and are great favorites. The nuts are gathered when the shells are fully matured but not thoroughly ripe. Sometimes these green nuts are imported into the United States. Many who have grown up in the country will recall the delicate flavor of the immature butternut and hickory nut and the stained fingers which they caused. Such green nuts have apparently never been marketed.

Whole green walnuts and some other nuts are also used in a quite immature state for pickle making. They are picked when still tender enough to be easily pierced by a large pin; then, after being kept in brine for a number of days, they are exposed to the sun until they turn black. Afterwards they are placed in jars and covered with hot vinegar and spices. Sometimes they are treated with dry

salt instead of brine before pickling. It is claimed that nuts thus treated will blacken without being exposed to sunlight. Such pickled nuts are considered by many as a very palatable dish for use with meats and poultry. Walnut catsup is also made from green walnuts.

NUT OILS AND OIL-CAKE MEALS.

In some parts of Europe almond oil, walnut oil, and beechnut oil are manufactured and prized as salad oils, and in South America Brazil-nut oil is used for table purposes. Cocoanut oil is an important oil in the Tropics. Peanut oil finds a large technical application and is also used in large quantities as a salad oil and for culinary purposes. Oils are also made from the kernel or nut of the peach and apricot, but these, like most nut oils except those mentioned, are used for medicinal or technical purposes.

The various nut oils, which are practically pure fats, have a very high fuel value, and, like olive oil and other oils, may constitute an important energy-yielding constituent of the diet. It is commonly assumed that, like olive oil, these oils are readily assimilated when properly combined with other food materials, as in salads, as "shortening" for various dishes, and in similar ways.

The oil-cake meals, as the ground products remaining after the expression of the nut oils are called, are much used as food for live stock and all kinds of poultry, and this is especially true of the peanut and cocoanut oil cakes. It has been suggested that such oil-cake meals might be valuable dietary articles if properly manipulated, as they of course contain a higher percentage of protein than the original nut. Some attempts have been made to thus utilize peanut-cake meal, but the results have not been very satisfactory.

PECUNIARY ECONOMY OF NUTS.

The composition and digestibility of nuts have been discussed in the foregoing pages, but little has been said regarding the cost of nutrients and energy which they supply as compared with other and more common food materials. The table on page 310 shows the comparative cost of a pound of protein and 1,000 calories of energy when furnished by different nuts and nut products and some other staple foods, and also the amounts of nutrients and energy which 10 cents' worth of these foods would supply, rating the foods at certain average prices per pound.

The common nuts—though, with the exception of the peanut, they are more expensive sources of protein and energy than meat and a number of the common foods—may yet be considered reasonably cheap sources of nutrients and energy, and hence may be regarded as justifiable additions to the diet on the score of economy. For

the vegetarian or fruitarian, who looks to nuts as the chief source of protein in the diet, the peanut must be considered as much the most economical. As may be seen by a reference to the table, 10 cents will purchase more protein and energy when expended for the flours and meals than for any of the other foods, but it must be remembered in this connection that these are the raw materials requiring considerable preparation before they are palatable. This is not necessary with fruits and nuts, except in the case of the peanut and chestnut, which are usually roasted before they are considered palatable by most persons, though there are those who prefer them raw. When considering nuts, it is readily observed that 10 cents will buy about the same amount of nut protein as of animal protein, except in the case of cheese and skim milk. If spent for peanuts, it will purchase more than twice the protein and six times the energy that could be bought for the same expenditure for porterhouse steak.

Pecuniary economy of nuts and nut products.

Kind of food.	Price per pound.	Cost of one pound protein.	Cost of 1,000 calories energy.	Amount for 10 cents.				
				Total weight of food material.	Protein.	Fat.	Carbohydrates.	Energy.
Nuts and nut products:	*Cents.*	*Dollars.*	*Cents.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Calories.*
Almonds	20	1.76	13.0	0.50	0.06	0.14	0.14	767
Brazil nuts	20	2.20	12.8	.50	.04	.16	.02	789
Chestnuts	8	1.48	8.3	1.25	.07	.06	.44	1,196
Cocoanuts	7	1.19	2.7	2.00	.08	.71	.27	[illegible]
Hickory nuts	9	1.55	7.2	1.11	.06	.28	.49	1,404
Peanuts	7	.32	3.6	1.43	.31	.47	.27	2,767
Pecans	15	2.47	9.1	.67	.04	.47	.09	1,098
Pignolias	25	.74	8.4	.40	.14	.20	.03	1,182
Pistachios	20	.88	9.1	.50	.11	.27	.08	1,124
Walnuts	20	2.66	15.5	.50	.04	.13	.01	663
Almond paste	40	3.17	21.0	.25	.06	.07	.13	475
Peanut butter	20	.68	7.1	.50	.15	.23	.09	1,412
Peanut candy	25	1.42	11.8	.40	.04	.07	.28	845
Other foods for comparison:								
Porterhouse steak	25	1.31	22.5	.40	.07	.07	....	444
Whole milk	4	1.21	12.0	2.50	.08	.10	.13	815
Cheddar cheese	16	.58	7.5	.62	.17	.20	.03	1,330
Wheat flour	3	.29	1.8	3.33	.38	.03	2.50	5,485
Beans, dried	5	.22	3.1	2.00	.45	.03	1.19	3,210
Potatoes	2	1.11	6.4	5.00	.09	....	.74	1,550

It is of more than passing interest to note that 10 cents' worth of peanuts will contain about 4 ounces (120 grams) of protein and 2,767 calories of energy, which is more protein and energy than is furnished by many rations regarded as adequate for a day. Although peanuts supply protein and energy for a smaller sum than bread, they are outranked by dried beans, which, at 5 cents a pound, will supply

for 10 cents over 200 grams of protein and 3,200 calories of energy. If more peanuts and dried beans were used by fruitarians, their diet would be enriched and the cost decreased. The almond, so much in favor with fruitarians, furnishes for 10 cents about one-fourth the protein and less than one-third the energy supplied by peanuts.

HANDLING AND MARKETING NUTS.

Within the last few years the trade in shelled nuts has very markedly increased, and shelled walnuts, hickory nuts, almonds, English walnuts, pecans, etc., are now very commonly found in shops. The bulk of the nut crop is, however, marketed unshelled. Some of the unshelled nuts, notably pecans and peanuts, are very often polished before marketing by rotating them in rapidly revolving drums in such a way that the shells are worn down until they are more or less smooth. This method of treatment also removes any dirt and is supposed to make the nut more salable. It is worthy of note, however, that the highly prized, large fancy pecans are marketed without such treatment.

For shelling nuts on a commercial scale a number of ingenious machines have been devised. In order to meet the market demand for clean and uniformly colored nuts, many nut growers have resorted to the process of bleaching their product. The first attempts in this direction were made by sulphuring; that is, by exposing the nuts to sulphur vapor. This treatment, though improving the color, proved decidedly injurious to the flavor of the nuts and lessened the keeping qualities. At the California experiment station experiments with bleaching solutions have been carried on and very satisfactory results have been obtained with a mixture of sal soda, chlorid of lime, and water. According to reports of the imperial department of agriculture of the West Indies,[a] a similar process has been successfully used for bleaching peanuts. The consumer should bear in mind that the bleaching of nuts is entirely unnecessary and in no way increases their food value. The process is carried on solely for the purpose of improving the appearance of the nut and thus commanding a higher price. It will doubtless be continued as long as the public is willing to be guided by appearance rather than food value. The term "bleaching," as applied to nuts, must not be confounded with the household term "blanching," which applies to the process of removing the skins from nut meats, as almonds, by immersing them for a short time in hot water.

Vegetables and fruits exposed for sale under ordinary conditions may be readily contaminated with bacteria, dirt, and dust. Nuts sold in their shells are protected in large measure from such contamination, yet many careful housewives wash, or at least wipe, the nuts

[a] Imp. Dept. Agr. West Indies Pamphlet No. 43, n. s.

which are to be cracked and served in the shells, as anything which adheres to the shell would readily contaminate the nuts after cracking, if all were mixed together in a dish. Shelled nuts, if exposed to dust in shops and markets, should be washed before they are used for salads, etc. If exposed to damp conditions, nuts mold and decay, and even under favorable conditions the nut oils and pits become rancid on long-continued storing. In the main, however, the keeping qualities of most nuts are excellent. Nuts should be stored in such a way that they may be free from attacks of insect enemies. When such precautions are not taken, "wormy" nuts are by no means uncommon.

SUMMARY.

Summarizing the foregoing data, it may be said that nuts are a very concentrated food, even more so than cheese, but when rationally used they are well assimilated and may form a part of a well-balanced diet. Nuts are a very valuable source of protein and fat, these two nutrients being the characteristic constituents of the more common nuts, of which the walnut and cocoanut may be taken as types. In nuts like the chestnut, carbohydrates are a characteristic constituent. For most families it is undoubtedly wiser to use nuts as part of the regular diet than as a condiment or supplement to an otherwise hearty meal.

Vegetarians and others who use nuts in place of meat should not depend upon them as the main food supply, but should supplement them with more bulky foods with a low content of protein and fat. As a whole, nuts may be classed among the staple foods and not simply as food accessories. At usual prices, nuts are reasonable sources of protein and energy. Peanuts supply protein and energy very cheaply, even compared with such staple foods as bread and beans. There are a number of nut foods on the market, but it may be stated that there is little to be gained from the standpoint of food value or economy in their use, especially by healthy persons who are willing to masticate their food thoroughly and to use nuts in reasonable combinations. Unless something has been added, the nutritive materials in such special preparations can not be greater than the nuts from which they are made, though in the mechanical condition or in some other way the foods may be better fitted for ready assimilation. Furthermore, nut butters and similar foods give a pleasant variety to the diet, and they are relished by many who would not care for the unprepared nuts.

Though less subject to contamination than many other foods, nuts should be handled and stored under good conditions, and especially should be protected from dampness and insect enemies.

SOME RECENT STUDIES OF THE MEXICAN COTTON BOLL WEEVIL.

By W. D. Hunter,
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INTRODUCTORY.

The boll weevil problem still remains a most important one for the cotton industry of this country. The insect continues to spread. Climatic barriers have given it temporary checks, but they have been successively overcome. The prediction that the pest will eventually reach the limits of cotton culture in this country has repeatedly been made, but an important consideration connected with the future spread has received less attention, largely because it has more recently become evident. This consideration is that damage in new regions is likely to be more severe than it has been in the territory infested up to this time. The experience of the past two years has rather tended to obscure some of the features of the weevil problem. The large crops produced in Texas have given an erroneous impression of the prospects. It is true that very remarkable results have been obtained in the work of the Department of Agriculture. Making due allowance for this important work, it must be stated that the recent large crops are largely due rather to a combination of conditions favorable to the growth of the plant and unfavorable to the weevil than to a lessened capacity for damage on the part of the insect. The work of the Bureau of Entomology has shown that in Texas, except in unusually wet seasons, a fair crop can easily be produced. The possibilities of production in a favorable season are shown by the fact that in 1906 the infested area produced about one-third of the total crop of the United States; but the same success will by no means necessarily follow in other regions where the conditions are different. Therefore future developments must be awaited with some solicitude.

THE STATUS OF THE COTTON BOLL WEEVIL IN 1906.

The total area infested by the cotton boll weevil in 1906 is indicated on the accompanying map (fig. 9). It extends over the greater part of the cotton-producing region of Texas, much of Louisiana, and comparatively small areas in Oklahoma and Arkansas.

This area extends a distance of about 590 miles northward from Brownsville, where the insect first invaded the State of Texas. The insect has also spread both to the west and to the east. At present

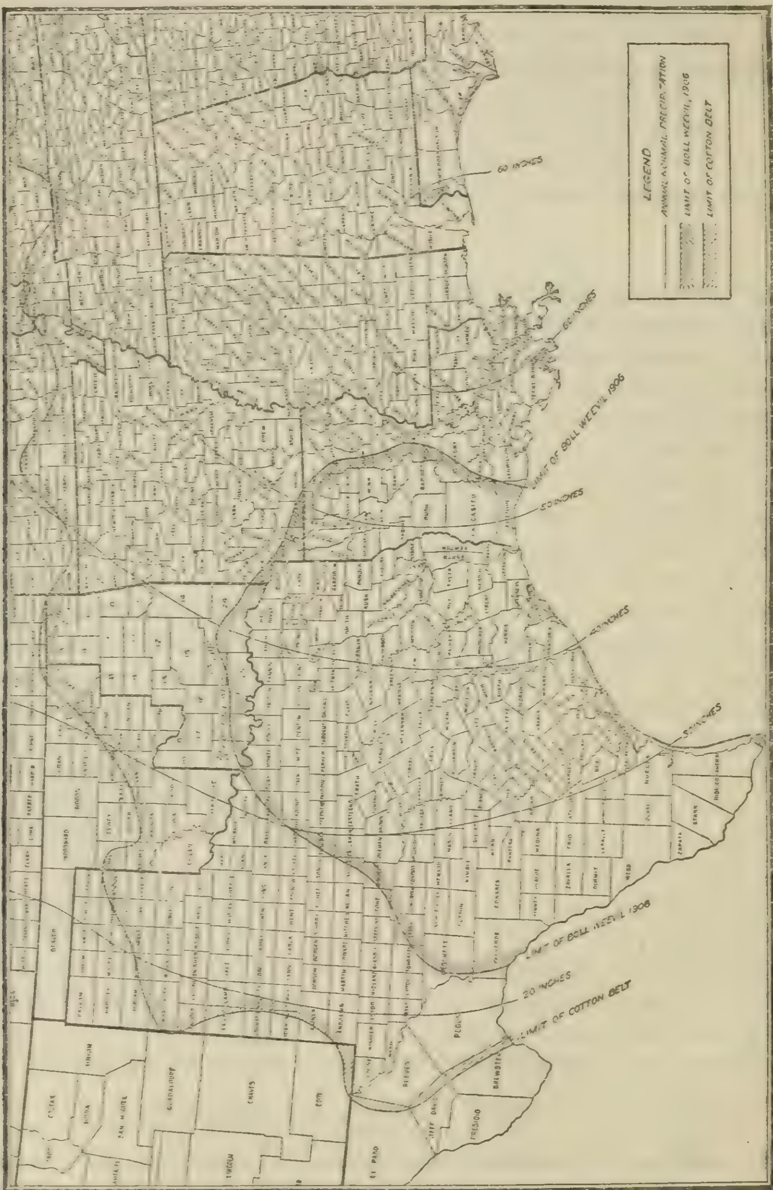


Fig. 9.—Map of the cotton belt in the United States, showing the area infested by the boll weevil in 1906 and the wide difference in the amount of annual normal precipitation in different portions of the infested and uninfested territory. (Original.)

the infested area extends a distance of 400 miles east and west. Within the infested area the annual rainfall ranges from about 12 inches in the west to more than 50 inches in the east. The altitude

varies from sea level to about 2,600 feet. The mean annual temperature varies from 72° at Brownsville, Tex., to 62° at Paris, Tex.

During the season of 1906 the increase in the infested area consisted of a belt varying in width from 20 miles in northwestern Texas to over 60 miles in northern Louisiana and Oklahoma. Over 1,500,000 acres of cotton land became invaded. This dispersion, however, began in August, so late in the season that no appreciable damage was done in this area. As a matter of fact, estimates of the damage for the year 1906 must be made upon the basis of the area infested in 1905.

One of the most interesting features of the situation in 1906 was the fact that a considerable advance was made directly northward into Oklahoma and Indian Territory. The insect reached points as far north as the Red River as early as 1904, specimens being found in Lamar County at that time. For three successive years the advance had been checked by winter conditions, but the season of 1906 witnessed a net gain northward of about 60 miles. The causes for this great advance after repeated checks are somewhat obscure. The preceding winter conditions in northern Texas were not especially favorable for the weevil. The precipitation was about normal, although the temperature was slightly higher than usual. Some study has been given this matter, but on the whole it does not seem that the climatic conditions alone would account for the northward advance. A more reasonable explanation seems to be that the weevil has gradually acquired an ability to withstand conditions that previously checked it. We thus have apparently another illustration of the adaptive capacity of the insect.

LOCAL VARIATIONS AND THEIR CAUSES.

In such a large area, where the climatic and geographic variations are so important that entirely distinct agricultural provinces have been formed, it would naturally be supposed that the boll weevil problem has various local aspects. It is true that there is no uniformity in the damage that is done throughout the affected area. In some regions the weevil has caused great depreciation in land values, while others have not suffered appreciably in this respect. In general, the drier and freer from timber the less is the damage by the weevil. The reasons for this are that dryness increases the death rate of immature stages in the fallen squares enormously in the summer and the absence of the protection afforded by timber contributes equally to a decrease in the number of adults in the winter. When the foregoing conditions are combined with low winter temperatures, as happens in northwestern Texas, there is a total of conditions most disastrous for the weevil. The reverse of these conditions is found

in the timbered valleys of eastern Texas and Louisiana, where the precipitation is much heavier.

In addition to the variations in weevil damage due to the decided constant differences in climate that have been mentioned, there are also local and temporary differences of climate and other conditions. These add to the large-area variations local modifications within the special regions. For instance, a local severe outbreak of the leaf worm in eastern Texas has been known to give that particular area comparative immunity from damage for one season.

Much information about the local variations affecting the weevil problem was gained in the spring of 1906 by a series of examinations to determine the number of hibernated weevils present per acre and later by a series of examinations to determine the extent of infestation by the first broods. These examinations were made practically simultaneously at over thirty localities. At each place entomologists made examinations of fields in different locations as regards the proximity of timber and other conditions which have a bearing upon the number of weevils which successfully pass through the winter. By a plan of examining a certain number of groups of plants in each cotton field it was possible to determine the average number of weevils present in that particular field. By averaging the number of weevils found in the different fields examined in any one locality the number of weevils per acre for that region was determined. By far the greatest number of hibernated weevils was found in eastern Texas, in Rusk and Shelby counties. In that quarter an average of more than 500 weevils per acre was found, and in some cases the number per acre reached nearly 700. This area extended well into Louisiana and comprised at least 500 square miles. A study of the conditions in this quarter gives the best possible indication of the conditions which will arise in the central and eastern portions of the cotton belt when they are reached by the weevil. Two widely separated regions showed an average of over 300 hibernated weevils per acre. One of these was in northeastern Texas, another in the coast region including Bee, Refugio, San Patricio, and Nueces counties. These areas were separated by extensive ones wherein comparatively few hibernating weevils were found.

Much of the recent advance in our knowledge of the boll weevil is the result of comparative studies of these areas of great damage and of other areas of comparative scarcity. The study has been continued by an examination of the statistics of production as far as available. The production by counties up to December 13, 1906, as determined by the Census Bureau, has been used. The crop of 1904 has been used as a basis of comparison for the reason that it may properly be considered a normal crop. In Louisiana, in the heavily infested portion, the percentage of increase of the crop of 1906 over

that of 1905 was 9.7 per cent of that of 1904. In the lightly infested area of Louisiana, however, the percentage of increase, determined in the same way, was 44.6 per cent. In Texas the increase in the heavily infested portion of the eastern part of the State was 12.9 per cent, and in the lightly infested region in the north-central portion of the State it was 59.9 per cent. These figures show clearly the temporary advantage gained through the scarcity of weevils in certain restricted regions.

THE RELATION BETWEEN WEEVIL DAMAGE AND PRECIPITATION.

For a long time it has been recognized that the most important single factor in assisting in the production of a cotton crop in a weevil-infested region is dryness during the growing season. An excellent illustration of this is furnished by the conditions in Victoria County, Tex., during the spring of 1906. The crop of that year in Victoria County is much the largest ever produced, although the acreage probably was not as large as has been planted in other seasons. The exact records regarding production are not available at this time, but a very conservative estimate of the crop of Victoria County for 1906 is 13,000 bales. From the accompanying table it will be seen that May and June were abnormally dry months; in fact, the total precipitation for April, May, and June (4.19 inches) was less than half of the mean total for those months for the five preceding years (9.28 inches).

Comparison of spring precipitation with the cotton crop in Victoria County, Tex., 1901–1906.

Year.	Precipitation.					Cotton crop, in bales of 500 pounds.
	April.	May.	June.	Total for three months.	Monthly average.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
1901	2.43	0.59	1.14	4.16	1.38	9,060
1902	2.85	3.23	2.03	8.11	2.70	9,236
1903	1.03	2.25	4.05	7.33	2.44	5,355
1904	3.33	4.37	5.32	13.02	4.34	6,495
1905	7.58	2.45	3.77	13.80	4.60	9,016
1906	2.88	.63	.68	4.19	1.39	[a]13,000

[a] Estimated.

While the total for April, May, and June, 1906, was only 4.19 inches, the mean total for 1901 to 1905 was 9.28 inches.

There can be no error in estimating the effect of dryness in this case, on account of the number of weevils present. In fact, far more than the usual number of hibernated weevils appeared in the fields of Victoria County up to the end of April. In one instance a total number of about 1,500 per acre was shown to have come to a certain

field. Of course, due allowance must be made for the effect of the work of parasites and the ant *Solenopsis geminata*, referred to elsewhere. However, the dryness rather interfered with the work of the ant and certainly did not facilitate greatly the work of the parasites. Dryness, therefore, must be considered as the controlling factor.

In the facts brought out in the preceding paragraphs we have the most exact basis at present available for an estimate regarding the manner in which the boll weevil will affect cotton production in the more humid regions that it is now invading. Taking Vicksburg, Miss., as a typical location in the Mississippi Valley, we find that the normal precipitation for April is 5.86 inches, for May 4.85 inches, and for June 4.31 inches. This gives a mean total for these months of 15.02 inches as against 9.28 inches at Victoria, and a monthly average for the same three months at Vicksburg of 5 inches as against 3.09 inches for Victoria. From these figures it is clear that the weevil conditions in a region like that of Vicksburg will normally be similar to those of the years of greatest precipitation in Texas.

FACTORS IN THE NATURAL CONTROL OF THE BOLL WEEVIL.

Valuable results have been obtained in an extensive study of the factors in the natural control of the boll weevil. Many climatic and other conditions are known to exert influences in reducing weevil damage. Low summer temperatures check the insect by lengthening the period of development, and the amount of the food supply is also a controlling element. Aside from such general influences and cultural expedients, the following are the principal factors which are now affecting the boll weevil in the infested region:

1. Heat and dryness during spring and summer.
2. The ant *Solenopsis geminata* and other predaceous insects.
3. Winter temperatures and moisture.
4. Proliferation.
5. Parasites.
6. The cotton leaf worm.
7. Determinate growth of the cotton plant.
8. Birds.

The above arrangement places these factors in the probable order of their importance at the present time. It must be remembered that future developments will undoubtedly necessitate a rearrangement of the above list. The work of *Solenopsis geminata* will probably increase from year to year, and the effect brought about by the leaf worm will give that insect greater importance as the weevil invades the Mississippi Valley proper. The above arrangement refers merely to the present conditions.

The importance of proliferation has been brought out forcibly by the writer's associate, Dr. W. E. Hinds, in Bulletin No. 59, Bureau of

Entomology. During the year 1906 special attention has been paid to heat and dryness, ants, and parasites, the last two of which are factors of which practical use could more or less easily be made.

Altogether 86,982 squares and bolls were collected and examined to learn the effects of these three factors. This material was collected in many localities in Texas, Louisiana, and Oklahoma. In it were found 38,883 weevil stages. Of this number 21.1 per cent had been killed by heat and dryness, 27.1 per cent by ants, and 4.3 per cent by parasites. The total effect of the three factors in Texas and Louisiana was to destroy 52.3 per cent of the weevil stages; that is to say, natural causes cut off more than one-half of the possible number of weevils. Moreover, more than one-half of this destruction was caused by the ant alone.

A comparison of the efficiency of these natural factors in Texas and Louisiana is of interest in showing the probable future aspects of the weevil problem. The combined effect in Texas was the destruction of 53.8 per cent and in Louisiana 44.1 per cent of the weevil stages. The rather close approximation of these percentages is due to the greater work of the ant in Louisiana, the two other factors being relatively unimportant in that State. In the case of ants the percentage of destruction in Louisiana was 35.7 and in Texas 31.3; in the case of heat and dryness 5.9 in Louisiana and 27.7 in Texas; and in the case of parasites 0.7 per cent in Louisiana and 3.5 per cent in Texas.

The work of the native ant *Solenopsis geminata* deserves special attention. The insect is distributed throughout the cotton belt, and in fact was found by Mr. E. A. Schwarz to be an important enemy of the boll weevil in Central America. It must not be confused with the Guatemalan ant, the importation of which has proved a failure. In this country the native ant was quite carefully studied by Mr. Schwarz and others in the early eighties. It has always shown an inclination to attack insects that it encounters in its travels up and down the cotton plant primarily for the purpose of obtaining nectar. It was natural to suppose that it might acquire a habit of feeding upon the boll weevil. Nevertheless, the rapidity with which the ant seems to be acquiring this habit is surprising.

Our attention was first especially directed to this matter during an experiment which was being made to test the effect of direct sunlight in destroying the immature stages of the weevil. One hundred and fifty squares believed to contain larvæ were divided into two lots and placed on the bare ground in the cotton plat at the laboratory in Dallas, Tex. One lot was left dried while the other was moistened to determine whether the mortality would be equally great in both cases. The squares were placed on the ground at 4.30 p. m., September 5. The following morning numerous ants were noticed running over and around them, although no signs of a nest had been seen the previous

evening. Subsequent observations showed holes in several of the squares in size and external appearance resembling weevil emergence holes so closely that at first they were mistaken for them. A more careful examination showed that the weevils had not emerged, but that the holes were really entrance holes made by the ants to enable them to get at the weevil within. Practically all of the squares had been opened. In the 75 squares kept dry the ants had entered 64, destroying probably 44 larval stages and 20 pupal stages. In the lot kept wet the ants had entered 73 of the 75 squares, destroying 50 stages probably larval, and 23 probably pupal. A remarkable fact was that out of the 150 squares in the lot only 13 were not entered by the ants, and 9 of these 13 were found on examination to have no weevil stages within them. It seems reasonable to conclude that the ants have some ability to determine from the outside whether there is some stage of the weevil within the squares.

It was thought that conclusions from this single experiment might be unreliable on account of artificial surroundings and the nearness of the squares to the nest, which, however, was more than 3 feet away. Subsequent experiments in cotton fields and the examination of thousands of fallen squares have all led to the opinion that the work attributed to the ants was not overestimated. The following are some records of the work of the ant shown by examination of squares picked at random from the ground in cotton fields in various parts of Texas: At Beeville, Tex., August 13, out of 874 weevil stages found 684 had been destroyed by ants. In another field, also at Beeville, on September 3, the ants had destroyed 11 out of 117 stages. At Dallas, on October 15, the ants had destroyed 39 out of 247 weevil stages. The following statement shows the results of extensive observations on the percentage of mortality in weevil stages brought about by the ant under different conditions:

Percentages of mortality of weevil stages brought about by the ant Solenopsis geminata.

Weevil stages.	Mortality.	
	In Louisiana.	In Texas.
	Per cent.	*Per cent.*
In fallen bolls	9	11.8
In fallen squares	5.9	27.7
In hanging bolls	11.8	7.8
In hanging squares	20.7	18.6

In view of the abundance of weevil food, there is certainly nothing surprising in the present indication that the ant is rapidly becoming an important enemy of the weevil. We have many letters from farmers scattered throughout the infested territory informing us of observations similar to ours on the work of the ants in cotton fields.

Some practical conclusions may be drawn from a comparison of mortality among weevil stages in fallen squares and bolls with the mortality found when the fruit remains attached to the plant. A careful investigation of this matter will be detailed in a bulletin to be issued in the near future by the Bureau of Entomology. The hanging forms referred to are only those which are to be found in a perfectly dead and dry condition but still attached to the plant by a thin strip of bark. This tendency seems to be more developed in the cluster varieties of cotton like the Dickson than in those that are more frequently planted in the infested region at the present time. However, individual plants in fields of any variety observed occasionally show the same tendency toward holding their fruit, and certain climatic and soil conditions seem to increase this tendency, sometimes to a conspicuous degree even in case of cotton of unknown pedigree.

It was early observed in the present investigation that the hanging forms show a considerably higher percentage of parasitism of weevil stages than the fallen ones. For instance, in a very extensive series of observations in Texas the percentage of parasitism in fallen squares was 3.5, but in hanging, 13.9. In Louisiana a somewhat less extensive series of observations showed a percentage of parasitism in fallen squares of 0.7 and in hanging squares of 8.3. At first these figures seemed to indicate that a variety which would more or less uniformly retain instead of dropping its infested fruit would be highly desirable in weevil-infested regions. Further data, however, show the fallacy of such a supposition and also incidentally indicate the danger of erroneous conclusions in such a complicated biological problem as the boll weevil presents. While the hanging forms showed much higher percentages of mortality due to parasites, the fallen forms showed a much greater percentage due to the other factors in natural control, namely, heat and dryness and the ant *Solenopsis geminata*. In Texas the percentage of mortality due to ants, in hanging squares, was 18.2, while in fallen squares it was 31.3; in Louisiana the hanging squares showed 32.3 mortality and the fallen squares 35.7 from the same cause. In Texas heat and drying brought about a mortality of 18.6 per cent in hanging squares and 27.7 per cent in fallen squares; in Louisiana the same factor resulted in a mortality of 5.9 per cent and 20.7 per cent, respectively. In other words, the combined effect of heat and dryness and ants in the fallen squares was much more important than the individual effect of parasites in the hanging squares.

From the results of the examinations made upon hanging forms it appears that the mortality found among nearly 10,000 weevil stages present averaged 42.6 per cent, while in the case of fallen forms, among approximately 30,000 weevil stages, there was a mortality of 56 per cent. From this extensive series of observations, covering a very wide range of variable conditions, it appears that the average

mortality resulting from the three natural factors under consideration was 13.4 per cent greater in fallen than in hanging forms. The mortality in hanging squares is very nearly as great as that in fallen bolls, but the mortality in fallen squares is nearly twice as great as in hanging bolls. It is noticeable, too, that a very large majority of weevil stages found were in the fallen squares.

These results indicate that those varieties of cotton which shed their infested squares and small bolls most readily and most completely will have an advantage by bringing the weevil stages contained in those forms under the most effective action of these important natural factors.

ADDITIONAL DATA CONCERNING IMPORTANCE OF FALL DESTRUCTION OF COTTON STALKS.

It has been considered by many that the destruction of cotton stalks after killing frosts was of little value in the control of the boll weevil. All observers have agreed that this process is of paramount value before that time. Recent data show clearly that the destruction of the stalks after several severe frosts is of great value; in fact, it is apparently only slightly less efficacious than earlier destruction. At Dallas, Tex., the first killing frost in the fall of 1906 occurred on the night of November 19. On the following day a careful estimate of the number of weevils per acre on a 60-acre experimental plantation was made. In different portions of the field 35 plants were examined and calculations were made on the basis of 8,300 plants per acre—probably not far from the usual number in Texas. From the 35 plants examined 29 live weevils were taken, indicating the presence of 6,477 live weevils per acre. On November 22 another examination gave an estimated number of 6,403 weevils per acre. An additional examination was made on December 1 after many heavy frosts. At this time 14 hibernating weevils were taken from 36 plants, indicating that 3,228 weevils per acre were present in the field. Examinations of the remains of bolls on plants on November 21 revealed 20 adult weevils in 325 bolls; that is, 6 per cent of the bolls selected at random in the field protected weevils. On December 8, 8 hibernating adults were found in the examination of 100 bolls.

From the above data it is evident that a farmer may control the number of weevils to a very considerable extent by the fall destruction of the stalks even very late in the season. The advantage of early destruction of the stalks, when possible, was shown by an examination on November 15, before the first killing frost occurred. At this time the leaf rubbish on the ground revealed adult weevils at the rate of 1,056 per acre. After the first killing frost a similar examination gave 2,844 weevils per acre. The frost had forced large numbers of weevils from the plants to the protection afforded on the ground.

EARLY VERSUS LATE PLANTING IN THE CONTROL OF THE BOLL WEEVIL.

[The upper illustration shows a cotton field planted late and yielding nothing. The lower illustration shows a field on the opposite side of the turnrow on same plantation, planted and treated in accordance with directions of the Bureau of Entomology, and yielding three-quarters of a bale per acre. (Original).]

The very great advantage the farmer may obtain by removing from the field and burning at the earliest possible date all débris which favors the hibernation of the weevil is evident.

LATE PLANTING.

An important step in the present method of control perfected by the Bureau of Entomology is early planting. At various times for a number of years different persons have suggested the possibility of controlling the boll weevil by late planting. It has been urged that early planting merely serves to breed myriads of weevils to injure the crop of the farmer who has been unable to plant early. It was thought possible that better results might be secured by lengthening the hibernation period by fall destruction of the plants, followed the next spring by late planting, and that this practice might actually result in the complete extermination of the weevil over as large areas as it could be applied to uniformly. (See Pl. XVI.)

Previous work (referred to in Farmers' Bulletin No. 216, pp. 20 and 21) resulted in a very small crop and seemed to show the fallacy of the proposed method. However, it was decided to obtain more exact information than was possible at the time of the previous experiment. Accordingly, at four places, representing different climatic conditions, carefully planned experiments in late planting were conducted in 1906. For these experiments fields were selected which were completely isolated from other cotton to prevent the inflow of weevils from other fields, which might have happened in the case of the previous experiment. In brief, the results of this work have amply verified previous conclusions. In not one of the four cases was any cotton whatever produced. The plants grew well, in some cases reaching a uniform height of about 5 feet, and the only apparent factor in preventing the maturing of a crop of cotton was the presence of the weevil. The most striking of the four experiments was located on the Edwards Plateau, about 30 miles west of Kerrville, Tex. At this place was found a field of 16 acres which had been in cotton in 1905. Very early in November of that year the owner turned a large herd of goats into the cotton field during a drought which had reduced his pasturage area. In a few days no traces of green portions of the plants were visible. The goats stripped the stalks of leaves, squares, and bolls. Cold weather following during November prevented the growth of any sprouts from the stalks that might have furnished sustenance for the weevils. No other cotton was planted nearer than 9 miles from this field either in 1905 or 1906. During 1906 the field was planted on June 10. The cotton grew to a height of about 5 feet, but weevils appeared practically as soon as the plants came up and soon multiplied sufficiently to cut off all the fruit. There is no reason to suppose that the weevils that did this damage were not those that passed the winter in the immediate vicinity. The

appearance of the first specimens found clearly indicated that they were hibernated individuals. Their numbers and the time of their appearance, together with a considerable amount of data now available as to the distance hibernated weevils can fly, show clearly that they had survived the long period from November to July without food.

Data obtained from weevils placed in cages in the fall of 1905 throw considerable light upon the obscure point of the possible length of the hibernation period. In an excellent series of experiments instituted by the Louisiana Crop Pest Commission at Keatchie under Mr. Wilmon Newell's direction, it was found that the weevils placed in wire compartments in the field on November 18 did not emerge until the 27th and 28th of the following June. In this case the arrangement of the experiment precludes any doubt whatever as to the ability on the part of the weevil to live in hibernation for a period of 221 or 222 days. Long before the last weevils had emerged the temperature had approximated that of the summer season and, of course, was much higher than that which caused weevils to seek hibernation in the fall.

An interesting point in connection with the study of the possibility of controlling the weevil by late planting was the general occurrence of volunteer plants coming from seeds falling to the ground in the fall. It was found at Dallas, Tex., for instance, that volunteer plants appeared in the spring at the rate of over 200 per acre. The number of such plants growing in the fields was greater in the western regions as the climate became drier, but numbers of volunteer plants were found in cotton fields along the roads near Memphis, Tenn., and in the neighborhood of Vicksburg, Miss., in a region having at least 50 inches of annual precipitation. The occurrence of this volunteer cotton of course could hardly be prevented. It would give a supply of food for weevils which would be practically certain to carry them through even in case planting could be deferred universally by the planters.

As the result of the work that has been mentioned we have emphasized the three following vital difficulties in the way of controlling the weevil by late planting:

(1) Emergence from hibernation may be deferred until practically the first of July.

(2) Everywhere numbers of volunteer plants occur which would furnish food for a certain number of weevils, regardless of how late planting might be deferred.

(3) Testimony from a large number of planters, which has been solicited on this point, and in fact the whole tendency of cotton planting show that to defer planting the crop until as late as the time when the last weevils may be expected to emerge from hibernation would prevent obtaining a crop, even if the weevils were entirely eliminated from the problem.

CLOUD-BURSTS, SO-CALLED.

By Edward L. Wells,
Section Director, Weather Bureau.

RELATION OF PRECIPITATION TO IRRIGATION.

It is the proud boast of the irrigator that he is independent of the elements; that it matters not to him whether his fields are wet with refreshing showers or whether the heavens are brass above them, and this is apparently true. But to him who takes more than a superficial view of the question it becomes evident that the irrigator is not independent of the forces of nature, for the streams from which he draws the water of which he boasts are supplied primarily by precipitation, which is subject to the same laws that govern the rain that falls in the field. Therefore he who would make no mistake in constructing reservoirs and canals to store the water and convey it where it is needed should know these laws and their application to the region from which the water is to be drawn. In making studies of climatic conditions preparatory to inaugurating irrigation projects the mistake is sometimes made of considering only the normal annual precipitation as determined by the records extending over a period of years. This might answer well enough in some instances, but in general the information should be much more complete. As for the annual values, in addition to the normal amount, one should know something of abnormalities that are likely to occur, particularly the least amount of precipitation that may be expected to occur in a year. Then there are various types of distribution of rainfall throughout the year. On the California coast, for instance, we find what is known as the Pacific type, in which there is a wet season extending from October to March, with the late spring and summer months nearly rainless. In Idaho there is the sub-Pacific type, with heavy precipitation in the winter and a secondary maximum for May, rendering the irrigation season shorter and storage comparatively simple, for the May maximum occurs at about the time of the most rapid melting of mountain snow, resulting in a large surplus of water in the height of the growing season; and the period of storage does not necessarily extend over more than three or four months. In Arizona is found what is known as the Arizona type, in which May and June are the months of least rainfall and more than one-third of the annual amount falls in July and August. Here the irrigating season is also shorter than in the Pacific type, but storage is much more difficult.

Another feature of precipitation which should not be overlooked is the intensity of the rainfall. At Phoenix, Ariz., for instance, during

the year 1904 the average amount of precipitation for each rainy day was 0.25 inch, while Winnemucca, Nev., with a much greater annual total, had only 0.11 inch per day. When rain falls during the growing season the cause of irrigation may be best served by the more intense type of precipitation, up to a certain limit, that limit itself being extremely variable in different localities, depending on the topography of the country, character of the soil, etc. The more rapid the rate of rainfall the higher will be the percentage of immediate run-off, but when the run-off reaches a sufficient magnitude it may become destructive to irrigation works and other property, and then any further increase in the intensity must lessen the benefits received.

APPLICATION OF THE TERM "CLOUD-BURST."

That rain does sometimes fall with such intensity as to result in great damage to property and even in the loss of human life is a matter of history, though it is very probable that these downpours are not so common as is generally supposed, and that their magnitude is greatly exaggerated. It has become a common practice to apply to such a rain storm the name of cloud-burst, though it is probable that few people at this day associate these storms with the phenomena, real or imaginary, to which the name was originally applied. Dr. Hugh Robert Mill, of Edinburgh, in his book entitled "The Realm of Nature," has this to say relative to cloud-bursts:

> The rapid condensation of water vapor in the axis of a tornado, or in the comparatively harmless whirlwinds that sometimes occur in all parts of the world, produces a dark funnel-shaped cloud tapering downward to the earth. Such a cloud occupying the center of an ascending eddy of air is called a waterspout. When it strikes the ground the heavy fall of rain on a very small area sometimes produces great destruction. At sea, or in passing over a lake or river, the low pressure of the whirling air of a waterspout often sucks up a column of water and whirls it on for considerable distances. In this way shoals of fish or swarms of frogs are sometimes raised high in the air, carried for miles inland, and dropped as showers of fish or frogs to the wonder of country people. It often happens that the upward rush in a tornado is strong enough to prevent the condensed water from falling until a great quantity has been accumulated; then it descends not as rain, but like a river, and the phenomenon is spoken of as a cloud-burst. On mountain slopes cloud-bursts have been known to hollow out deep ravines in a few minutes. Severe accidents of this description occasionally occur in the Cordilleran district of North America. Hail as well as rain may be similarly accumulated, and the worst hailstorms occur during the passage of a tornado.

This reads very well, but, before accepting it, it is well to remember that cloud-bursts are most often heard of in mountainous regions, while tornadoes are largely a phenomenon of the plains.

Gen. A. W. Greely, while Chief Signal Officer of the United States Army, in his book entitled "American Weather," wrote of cloud-bursts as follows:

> Apart from even exceedingly heavy showers or downpours may be classed the enormous masses of water which now and then fall, and which are popularly known in

America as cloud-bursts or waterspouts. In such cases the amount of water that falls in an hour or two must equal rainfalls which are otherwise deemed excessive for a day or even a month in the region. These downpours of torrential rain are fortunately local, and yet more frequently prevail in the less densely populated portions of the country.

In his report on the rainfall of the Pacific coast and Western Territories, issued in 1889, General Greely speaks of cloud-bursts:

> It is well known that enormous quantities of water occasionally fall in these arid regions, the phenomena being known as cloud-bursts. These downpours of rain, while injurious and even destructive at the time, yet, being taken up by the earth, they serve usefully later as a water supply, through the medium of rivers, artesian wells, or springs. The quantities which fall in a single cloud-burst can not be calculated, but the amount can be expressed by no other word than enormous.

He follows this with an account of a number of instances of precipitation considered by him worthy of mention under this head.

CONCENTRATION OF RAINFALL AS AFFECTED BY TOPOGRAPHY OF COUNTRY.

It might seem from the foregoing that we would be justified in putting these extremely heavy rainfalls in a class by themselves and in applying to them the term "cloud-bursts." However, since the publication of the opinions already quoted there has been a wonderful increase in the population of the Western States and Territories, observation stations have been multiplied, and much of the mystery that formerly surrounded the so-called "Great American Desert" has been cleared away; and modern meteorologists have come to believe that in many instances at least the damaging floods occasioned by what are called cloud-bursts are not so much a result of extraordinary and unexplained meteorological phenomena as they are the result of a topography favorable to a high percentage of run-off, and a concentration of this run-off into a comparatively narrow and swift-moving stream. This belief is expressed by William Morris Davis, professor of physical geography at Harvard College, in his Elementary Meteorology, as follows:

> The cloud-bursts of our arid western districts are only exaggerated thunderstorms. They are local and short-lived, and seem to result from the sudden overturning of a large mass of unstable atmosphere. The clouds that accompany these storms have every feature indicative of a convectional origin, and, as with us, may be placed at the end of a well-continued series, beginning with ordinary cumulus clouds; passing then to moderate thundershowers, from which so little rain falls that it evaporates on its way down through the thirsty lower air, and hardly a drop reaches the parched ground; next to more active local thunderstorms of the usual type; and all these culminating in the drenching fall of waters from the cloud-burst. A narrow strip of country is inundated by such storms for a short distance; temporary streams then rush down channels that are nearly dry at other times, gathering sand and dust, and delivering the discharge of the storm to the main valleys in dark, muddy torrents, many miles from the place of the rainfall.

It is a notable fact that storms to which the term "cloud-burst" is applied do occur in mountainous districts, and that the damage caused is nearly always confined to narrow valleys through which the run-off from considerable areas must find its way. Stop to consider that even 1 inch of rain represents a fall of more than 72,000 tons of water on a single square mile, and it will become evident that it does not require such a remarkably heavy rain storm over a catchment basin of, say, 10 miles square, discharging through a narrow canyon, to produce all the effects that we associate with a cloud-burst. A rain of 6 inches over such a basin would represent a fall of 43,509,832 tons of water. Among the more recent destructive floods arising from this cause may be mentioned that which destroyed the town of Heppner, Oreg., in June, 1903, causing the death of nearly 200 people. An investigation of the area covered by the storm and the amount of water discharged through the valley was made almost immediately by Mr. John T. Whistler, a representative of the United States Geological Survey, who reported that a fall of an inch and a half of rain over an area of 20 square miles, the probable area of the storm, would account for all the water of the flood. To show that this is not a phenomenally heavy downpour, the following instances may be cited: At St. Louis, on August 15, 1848, a precipitation of 5.05 inches occurred in one hour; at Indianapolis, on July 12, 1876, 2.40 inches fell in twenty-five minutes; at Huron, S. Dak., on July 26, 1885, 1.30 inches fell in ten minutes; at Sandusky, Ohio, on July 11, 1879, 2.25 inches fell in fifteen minutes; at Madison, Wis., on August 8, 1906, 4.45 inches fell in one hour and twenty minutes; at Jacksonville, Fla., on May 12–13, 1903, 8.03 inches of rain fell in less than twenty-four hours. In the records none of these rain storms was spoken of as a cloud-burst, but had any of them occurred among our western mountains, over such a drainage area as that discharging through the Cottonwood at Boise, for instance, all the phenomena usually attendant upon a cloud-burst would have been in evidence. Commenting on Mr. Whistler's report of the Heppner flood Mr. Edward A. Beals, district forecaster in charge of the local office of the Weather Bureau at Portland, says:

> Scientists have never been able to account for "cloud-bursts" as anything more than heavy thunderstorms; therefore Mr. Whistler's conclusion that the ruggedness of the topography rather than the quantity of the rainfall causes their great destructiveness appears to be well taken, and, if correct, loss of life and property in such cases is not due to the "visitation of Providence" so much as to the "folly of man" in building cities and towns in such exposed localities.

It would seem, then, that one of the most important things to be considered by engineers in planning irrigation works would be the probable maximum intensity of the rainfall, in its relation to such features of the topography of the country as might favor the discharge of large amounts of water through narrow valleys.

NEW CITRUS AND PINEAPPLE PRODUCTIONS OF THE DEPARTMENT OF AGRICULTURE.[a]

By HERBERT J. WEBBER,

Physiologist in Charge of Plant-Breeding Investigations, Bureau of Plant Industry.

NEW CITRANGES.

Of the new group of citranges or cold-resistant oranges, there have previously been described three new varieties which were produced in the course of experiments conducted by the Department of Agriculture, namely, the Rusk, Willits, and Morton. Nursery trees of these three varieties, budded on trifoliate orange stock, have been distributed to a limited number of interested growers in order that the varieties may be thoroughly tested and become generally disseminated. It is the object of the Department to make but a limited distribution of any variety, striving only to secure its thorough trial and general adoption in cultivation if the variety proves valuable. As soon as good stock is obtainable from a number of nurserymen there is no need for its further distribution by the Department. The first trees of the Rusk and Willits were distributed in the spring of 1905 and the Morton was distributed a year later. Sufficient time has not elapsed to allow any of these trees to reach bearing age, and no further data are thus available in regard to their adaptability to various sections, soils, etc. In the Department's experimental orchard the trees have been continued under trial. The Rusk has proved a very prolific variety, producing numerous well-formed fruits. The fruits of this variety, which are rather small, have for the last two seasons been larger than those produced in the early fruiting of the same trees, showing a tendency to produce somewhat larger fruit as the trees mature in age.

The Willits has in some respects proved disappointing. The fruits of this variety, which were described as rather rough and furrowed, have, as the trees grew older, become more irregular. Fruits are frequently developed which have several of the segments protruding above at the apex in free ends, similar to the so-called "fingered citron," though none of these free ends are so long as in that fruit. When a number of the segments protrude in this way, as occurs in some instances, the shape of the fruit reminds one strikingly of a

[a] In an article in the 1904 Yearbook entitled "New Citrus Creations of the Department of Agriculture," the writer, in conjunction with Mr. Walter T. Swingle, described two new citranges, the Rusk and Willits; one new tangelo, the Sampson; and two new tangerines, the Weshart and Trimble. In the 1905 Yearbook, in an article entitled "New Fruit Productions of the Department of Agriculture," the writer described one more citrange, the Morton; two limes, the Palmetto and Everglade; and five new pineapple hybrids, the Miami, Seminole, Eden, Matthams, and Gale. The work of the Department in the breeding of oranges and pineapples was at first conducted jointly by Mr. Walter T. Swingle and the writer, but since 1897 has been carried out by the writer, who has received valuable aid from Prof. P. H. Rolfs, Dr. E. A. Bessey, and P. J. Wester, of the Department's Subtropical Garden, in connection with the experiments, and from Mr. J. B. Norton and Mrs. L. H. Webber in testing the fruits and making the necessary notes.

summer squash. Even in the most deformed fruits, however, the pulp is very juicy and can be used as a substitute for the lemon or lime. This variety shows a tendency, furthermore, to drop a considerable portion of the fruit before it ripens, probably due to the abnormality and imperfect development. The writer would advise that this variety be propagated sparingly. It is, however, an interesting and curious fruit and is well worthy of propagation as a lawn tree.

The Morton trees at the experiment station at Lake City, Fla., and in the Government orchard at Glen St. Mary, Fla., last season produced a good crop of fine-shaped and fine-appearing fruit. The variety is without doubt one of the best of the citranges. By Ridgway's standards the skin color of the Morton is deep chrome to cadmium yellow and the pulp is between chrome and saffron yellow. These records of color by Ridgway's standards were not given in the original description of the Morton.[a]

The writer wishes again to emphasize the statement that the citranges must not be confounded with oranges. They are not oranges, and are no more to be compared to oranges than are lemons. They are new fruits of the citrus group which are much hardier than the orange or lemon, and which may be grown from 300 to 400 miles north of the present orange region. They are principally of value for culinary purposes and for making citrangeade. As an ade fruit they are to be highly recommended, as the different varieties present different and attractive flavors.

Many inquiries have reached the Department regarding the methods of propagating the citrange varieties. The writer would advise that they be budded on 2 or 3 year old seedlings of the Trifoliate orange. This is a perfectly hardy stock, which can be grown successfully anywhere in the southern United States. The ordinary method of eye-budding which is practiced in the propagation of oranges, apples, peaches, etc., is used. It has thus far been impossible to conduct experiments in the manuring and cultivation of the citrange, and in the absence of exact knowledge the writer would recommend that in the different sections about the same manuring and cultivation be given as is used with oranges, pears, or apples in those sections.

In this paper there will be described three new citranges—the Colman, the Savage, and the Rustic. All of these varieties are sister fruits of the Willits and Morton, all having developed from seeds of a single fruit of Trifoliate orange which was crossed by Mr. W. T. Swingle with pollen of the common sweet orange in the spring of 1897, in the grove of Col. G. H. Norton, at Eustis, Fla. Forty seedlings were grown from this single hybrid fruit, which, since their germination, have been under the care of the writer. A careful study has been

[a] The colors referred to in this paper as Ridgway's standards are the determination of the colors by a careful comparison of the fruits with the standard color plates given in A Nomenclature of Colors, by Robert Ridgway; Boston, 1886.

made of the 40 different seedlings and, with the publication of this paper, 5 of them will have been named as new varieties of citranges. While the final value of none of the citranges has yet been certainly established, the writer feels certain that they will ultimately prove of inestimable value and be cultivated extensively in many parts of the world.

The hardiness of the Colman, Savage, and Rustic citranges described in this paper has not been thoroughly determined, but the experiments have shown them to be apparently as hardy as any of the other citrange varieties. At Glen St. Mary and Lake City, Fla., and at the Georgia and Alabama experiment stations they have several times endured freezes without injury, when the temperature went as low as 15° and 16° F. There would seem to be no doubt that in most locations these trees may be successfully grown in regions from 300 to 400 miles north of the present orange belt of Florida. The writer would recommend their thorough trial in South Carolina, Georgia, Alabama, Mississippi, Louisiana, and the warmer parts of Tennessee, Arkansas, and Texas. They can certainly be grown in regions of low altitude in New Mexico and Arizona and in the warmer sections near the coast of Washington, Oregon, and northern California. They may be safely recommended for any section which is only slightly too cold for the ordinary orange.

THE COLMAN CITRANGE.

[PLATE XVII; PLATE XX, FIGURE 2.]

The Colman citrange is a hybrid of the Trifoliate orange with pollen of the common sweet orange, and is closely related to the Morton and Willits, having developed from another seed of the same hybrid fruit. This new citrange has been named the *Colman* in recognition of the valuable services to agriculture and to this Department of Hon. Norman J. Colman, under whose administration, as Commissioner of Agriculture, the agricultural work of the Government was organized as a separate Department. The Colman is a remarkable hybrid, having fruits as large as the ordinary orange and of fine appearance. It is very different in character from any other of the citranges and is easily recognizable.

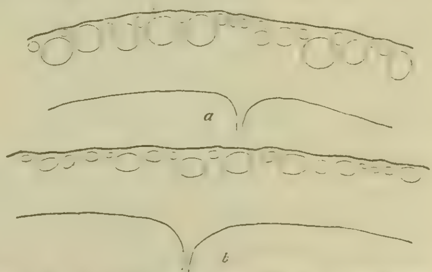


FIG. 10.—*a*, Section of the skin of the Savage citrange, showing the shape and arrangement of the oil glands; *b*, section of the skin of the Colman citrange, showing the shape and arrangement of the oil glands. (Twice natural size.)

DESCRIPTION OF FRUIT AND TREE.—Fruit compressed spherical, frequently rather one-sided or oblique, large but rather smaller than the Morton, 2$\frac{1}{8}$ to 2$\frac{7}{8}$ inches high and from 2$\frac{3}{4}$ to 3$\frac{3}{4}$ inches in diameter; color light orange or lemon yellow, lighter than

Morton or Willits (by Ridgway's standards Colman is between saffron yellow and Indian yellow, while Morton is between deep chrome and cadmium yellow); surface mainly very smooth, slightly roughened as in ordinary orange by slight depressions over some of the large oil glands, covered with numerous short, stiff, colorless hairs, occasionally with a few slight furrows near base; weight heavy for size of fruit, from 6 to 9 ounces, usually averaging about 8 ounces, somewhat lighter than water; calyx persistent but dried up and inconspicuous as in case of ordinary orange; rind medium thin, one-eighth to three-sixteenths of an inch in thickness, adhering to fruit about as in the ordinary Florida orange, being removed with moderate ease; in taste bitter and disagreeable, intermediate between the ordinary and Trifoliate orange; oil glands small and comparatively few, spherical or oblate-spherical, with major axis parallel to surface, smaller and of different shape from those of the Morton, Savage, and other citranges, and closer to the surface (fig. 10, b); pulp translucent, light lemon yellow (by Ridgway's standards wax yellow), lighter than the pulp of Morton; pulp vesicles longer and smaller in diameter than those of the ordinary orange; tender; segments 10 to 14; separating membranes somewhat thicker than in good ordinary oranges, with pronounced bitterness derived from the Trifoliata; texture of fruit tender, very juicy; axis small, one-fourth to one-half an inch in diameter; flavor a sprightly bitter acid, nearly as sour as a lemon and with a peculiar stimulating bitter taste; almost totally seedless, averaging 1 seed to 6 fruits; aroma very pleasant and pronounced, differing from any other citrus fruit, suggesting Trifoliata, but milder; tree similar to Trifoliata in shape, but with denser foliage, evergreen or semievergreen, thorny, of medium height, and sturdy; fruit stems large and stiff, in many cases holding fruit erect; leaves in general trifoliolate, but frequently unifoliolate, nearly twice the size of those of the trifoliate orange; season of maturity medium early, from middle of September to last of November.

The Colman citrange is an exceedingly interesting hybrid in its combination of parental characters. It is the only one of the citranges thus far secured which has inherited in any marked degree the fuzzy fruit character of the Trifoliate orange. The fuzz on the Colman fruit, however, in no way detracts from its good appearance and is thus not a detrimental character. The foliage is in general slightly larger than any of the other Trifoliata × orange hybrids which have been secured and is nearly half unifoliolate, like the orange. In foliage characters, therefore, the Colman is more like the common orange than any of the other citranges. In odor and flavor it is nearly intermediate between the two parents. In shape and arrangement of oil glands it is different from either parent or from any other citrange which the writer has examined. While the majority of the Colman fruits show very little indication of furrows, some fruits, as, for instance, one shown in Plate XX, figure 2, have pronounced furrows radiating from the base and reaching nearly to the apex of the fruit. The tree of the Colman is very thorny, but the writer has observed many branches having the thorns almost entirely suppressed, and it is highly probable that the thorns may be bred out, as in the case of varieties of the common orange, by selecting buds for propagation from such thornless branches. The almost total seedlessness of this variety is somewhat remarkable and greatly adds to the value of the fruit. A record of 102 fruits examined in the last two years shows an average of only 1 seed to 6 fruits.

The Colman is primarily recommended for use in making citrangeade. It makes a rich orange-colored ade of high quality, with a dash of bitterness, which is very attractive to some palates. This quality, like the bitter principle of the grapefruit, is doubtless stimulating

E. I. Schutt

COLMAN CITRANGE. NATURAL SIZE

E. I. Schutt

SAVAGE CITRANGE. NATURAL SIZE

RUSTIC CITRANGE. NATURAL SIZE.

FIG. 1.—BRANCH OF THE SAVAGE CITRANGE. ONE-HALF NATURAL SIZE.

FIG. 2.—BRANCH OF THE COLMAN CITRANGE. ONE-HALF NATURAL SIZE.

and healthful. The juiciness of this variety, its seedlessness, and its large size specially fit it for use as an ade fruit. It also makes a very fair marmalade, and other uses for the fruit will doubtless be found. The tree is of fine appearance and well worthy of cultivation as a lawn tree, aside from the value of its fruit.

THE SAVAGE CITRANGE.

[PLATE XVIII; PLATE XX, FIGURE 1.]

One of the best citranges in size, shape, and appearance which have been secured in the course of the Department's experiments is hybrid No. 779, a cross of Trifoliate orange with pollen of sweet orange, and a sister seedling of the Willits, Morton, Colman, and Rustic. This hybrid has been named the *Savage*, after Mr. Frank Savage, of Eustis, Fla., in whose orange grove many of the Department's hybridization experiments were started. The Savage produces a large, usually well-shaped fruit and is apparently a valuable variety, differing considerably from any of the other citrange varieties. Following is a technical description of the variety:

DESCRIPTION OF FRUIT AND TREE.—Fruit spherical or slightly compressed spherical, frequently slightly oblique; of medium size, from 2 to $2\frac{5}{8}$ inches in height and from $2\frac{1}{4}$ to $3\frac{1}{4}$ inches in diameter; weight from 3 to 8 ounces, average about 6 ounces, considerably lighter than water, being less dense than the Colman; color light orange yellow (by Ridgway's standards between saffron yellow and Indian yellow), thus being almost the same color as Colman and lighter than the Willits and Morton; surface in some fruits smooth, in others considerably roughened by depressions; many fruits have very pronounced furrows, running from the base to the apex, while others show only slight furrows or none; with a few hairs on rind, but these very small and invisible without lens; calyx persistent but inconspicuous as in ordinary orange; rind of medium thickness, one-eighth to three-sixteenths of an inch, adhering rather closely to fruit, suggests orange in taste, but with considerable bitterness from the Trifoliata parent; oil glands spherical or ovate, similar in shape and appearance to those of ordinary orange and being different in shape and more numerous than those of Colman (fig. 15, *a*); pulp tender, translucent, light yellow (by Ridgway's standards between wax yellow and Naples yellow); pulp vesicles fusiform, varying in size, smaller than in ordinary orange but much larger than in Trifoliata; segments 8 to 10; separating membranes moderately tender, slightly bitter, texture tender and juicy; axis small, one-fourth to five sixteenths of an inch in diameter; flavor a sprightly acid, somewhat bitter, not so sour and bitter as Colman, more similar to the Morton; seeds few, usually averaging 3 or 4 per fruit; aroma pleasant but light, has a suggestion of apple odor; tree similar to Trifoliata, very vigorous and prolific; hardy, evergreen or semi-evergreen; without pruning grows rather tall and slender; foliage dense; leaves mainly trifoliolate, some unifoliolate, large; season of maturity medium early, from September 15 to last of November.

The Savage citrange is apparently the most fruitful of all of the citrange clons, or varieties, aside from the Rusk. The trees in the Government test grove were last year (1906) laden with a very full crop of nice appearing fruit, hanging on the tree in bunches. The fruit runs uneven in size and shows some tendency toward freakishness, a few cases of protruded segments having been observed. From the fewness of these among the comparatively large number of fruits developed, it is believed that it is not a seriously detrimental character. The fruit is not quite so sour and bitter as the Colman, being more nearly like the Morton. By those who like a sour fruit it can be eaten out of hand with sugar. It makes a good ade and a fair

marmalade, and can doubtless be used in many places where limes and lemons are now used.

The tree has dense dark-green foliage and will make a fine appearing lawn tree. It may make a good hedge plant when pruned, but pruning on top would probably be necessary, as the test trees do not seem to develop many basal branches. The Savage is one of the most vigorous growers of any of the Trifoliata × orange hybrids, and, as it produces a considerable number of seeds, it is worthy of careful trial as a hardy stock on which to bud the varieties of the ordinary sweet orange. The Trifoliate orange is used extensively at the present time, but many orange growers object to it, owing to its tendency to dwarf the trees. The Savage, being much more closely related to the sweet orange, an exceptionally vigorous grower, and wholly resistant to any degree of cold which would affect the sweet orange, would seem to possess all of the desirable qualities of the Trifoliata as a stock and would probably not have the same dwarfing tendencies. It might be supposed that, being a hybrid, the seedlings would be too variable to permit of using them in this way. While the variability of the seedlings of the various citrange clons has not been fully determined, a number of seedlings have been grown, and the foliage characters of these are in all cases remarkably like those of the parent variety, showing no reversions to the pure Trifoliata or pure orange, as might be expected. While the value of the Savage as a stock is entirely problematical, it is sufficiently promising for the writer to recommend its thorough trial.

THE RUSTIC CITRANGE.

[PLATE XIX.]

All of the citranges which have been named have tree characters which render them desirable for cultivation in the South as ornamental lawn trees or hedge plants, entirely aside from their value for the fruit they produce. Hybrid No. 783, which, as stated previously, is a seedling from the same hybrid fruit as the Colman and Savage and is thus a hybrid of Trifoliata with pollen of sweet orange, does not produce as good a fruit as those varieties, but produces a rather more bushy, low-growing tree, which is believed to render it especially desirable for cultivation as a lawn tree or hedge plant. This hybrid has been given the name *Rustic*, which suggests the use for which the variety is recommended.

DESCRIPTION OF FRUIT AND TREE.—Fruit nearly spherical, of medium size, from 2 to 2¼ inches in diameter and from 2 to 2¼ inches in height; weight medium, averaging about 5½ ounces per fruit; density lighter than water; color light yellow (by Ridgway's standards chrome yellow); surface covered with small inconspicuous hairs which are scattering and hardly visible without lens, fairly smooth, with small indentations over some of the oil glands, as smooth as many sweet oranges, frequently with slight furrows radiating from the stem and extending toward apex of fruit but seldom reaching beyond middle of fruit; calyx persistent but inconspicuous, as in ordinary orange; rind medium thin, one-eighth to seven thirty-seconds of an inch in thickness, adhering rather closely to fruit, as in ordinary orange, bitter to taste; oil glands prominent,

mainly round or pear-shaped, with major axis at right angles to surface; pulp light, translucent, greenish yellow, similar to the pulp color of ordinary lemons (by Ridgway's standards nearest to primrose yellow, but this color is not exactly correct); pulp vesicles small and slender, not so juicy and melting as the Rusk, Colman, or Savage; segments 6 to 12, separating membranes rather thicker and firmer than in ordinary orange, slightly bitter; texture of fruit moderately tender; axis small, one-fourth inch in diameter; flavor a characteristic citrange acid with some bitterness, rather similar to the Willits; number of seeds variable; some fruits have as high as 24 seeds, while others are seedless; aroma light but pleasant; tree similar to ordinary sweet orange, spreading and branched below, differing in this regard from other citranges; vigorous and cold-resistant, evergreen or semi-evergreen, of medium height and shapely; leaves trifoliolate, dark green, larger than those of Trifoliate orange; season of maturity medium early, from middle of September to last of November.

The tree of the Rustic budded on Trifoliate orange stock differs considerably in shape from that of any of the other citranges, developing fairly long lower branches, which are more widely spreading than in the Trifoliate orange or the other citranges, and giving the tree greater breadth near the ground. The tree of the Rustic is thus in shape much nearer to that of the ordinary sweet orange. In the other citranges there are fewer large branches developed near the ground, and such as there are have a tendency to grow erect and stiff, giving the tree a shape more nearly like the Trifoliate orange. The foliage of the Rustic is dense, dark green, and mainly evergreen, and the twigs, as in the case of all of the citranges, are armed with long, stiff spines. It thus possesses all of the characters which fit it for use as a hedge plant. The Rustic fruits in the seasons of 1904 and 1905 developed numerous seeds, ranging usually from 12 to 24 seeds per fruit. In 1906, however, for some unknown reason almost all of the fruits were nearly seedless. If the variety is to prove satisfactory for hedge purposes seedy fruits are desired, and it is desirable to learn what factors are conducive to seed production. The writer's experience at the present time is not sufficient to enable him to give intelligent suggestions, but he believes that ordinarily a sufficient number of seeds will be produced to use for propagation purposes. While the seedlings will doubtless vary somewhat, the experience with the citranges up to the present time indicates that they almost invariably produce seedlings with foliage characters like those of the parental variety. Cuttings from the citranges can be rooted fairly easily in hothouses with bottom heat, and it may prove practical to propagate trees in this way. Satisfactory stock for planting hedges could be secured by budding on Trifoliate orange stocks, but this would make the plants rather too expensive for hedge purposes.

As in the case of the Savage, it is believed that the Rustic might also prove a desirable hardy stock on which to bud the various clons of the ordinary sweet orange, lemon, etc. If it develops sufficient seeds from which stocks may be grown the writer would suggest its careful trial for this purpose.

While the fruit of the Rustic is not so large or juicy as some of the other citranges, it is nevertheless of fairly good quality, and, as in the

case of the other citranges, makes a good citrangeade and may be used in making marmalades, pies, cakes, etc.

New Loose-skinned Orange—The Thornton.

In the citrus-breeding experiments of the Department the improvements which it would be desirable to obtain were carefully studied and the combinations of parents were planned which would be most likely to produce these improvements. The loose, easily removable skin or "kid-glove" character of the tangerine and mandarin oranges was recognized as a very valuable character, as probably the majority of oranges are eaten by peeling and separating the segments. The various clons of the tangerine and mandarin group of oranges, however, are sweet, rather insipid, and dry, and as a class lack the rich juiciness and sprightly high quality of the ordinary orange. It was thought that by hybridizing the tangerine with the common orange hybrid varieties might be secured combining the most desirable qualities of the two classes of fruits. With this in view many hybrids were made of the tangerine with the common orange and the reciprocal combination. None of these hybrids which have thus far fruited has given the desired combination of characters. It is surprising, however, that almost the exact fruit sought has resulted from a hybrid of the pomelo with pollen of tangerine, the same combination that gave the tangelo, though not from the same hybridized fruit. This hybrid, Thornton No. 5, has the loose skin and easily separable segments of the tangerine and also shows the tangerine in the form and color of the pulp vesicles and the green color of the cotyledons. The character of the pomelo or grapefruit, which is supposed to be the female parent, is, however, hardly discernible in any character. The writer, from the characters of the fruit, would suppose it to be an orange × tangerine hybrid rather than pomelo × tangerine. The original label of this hybrid was lost, but only pomelo × tangerine hybrids were sent to Mr. Thornton, who grew this hybrid to fruiting, and there would thus seem to be no doubt as to the parentage. An error may have been made, however, and if so it will probably be discovered later in the course of the further experiments. Regardless of the parentage, this hybrid is believed to possess valuable characters and to be worthy of general cultivation. It has therefore been named the *Thornton*, in recognition of the aid which Mr. C. B. Thornton, of Orlando, Fla., has given the Department in connection with these experiments. A technical description of the variety follows:

Description of fruit and tree.—Fruit oblate, flattened at the apex and tapering from about the middle to the base; size medium large, $3\frac{1}{4}$ to $3\frac{3}{4}$ inches in diameter by $2\frac{7}{8}$ to $3\frac{1}{4}$ inches high; color orange, about the same shade as the ordinary Florida sweet oranges; surface somewhat rough, similar to the King orange, but not so markedly rough as in that variety; skin medium thick, one-eighth to one-fourth of an inch (rarely as thick as shown in Pl. XXI), flexible and tough, being easily removable, like

the skin of the tangerine; oil glands large and conspicuous; segments 10 to 12, separating easily like tangerine and with considerable adhering white soft membrane, as in that fruit; separating membranes comparatively thin and tender; axis small, except in old fruits, one-half inch in diameter, mainly hollow, as in tangerine; quality excellent; texture tender, very juicy; flavor a mild, rich subacid, very attractive but characteristic, not like any other citrus fruit; no indication of bitterness from pomelo; pulp orange-colored; seeds 5 to 12 per fruit, resembling orange in shape but with greenish cotyledons, similar to the tangerine; aroma not unlike ordinary orange with suggestion of bitter-sweet orange, attractive; tree evergreen, having general characters of ordinary sweet orange; leaves unifoliolate; time of ripening midseason.

It might be assumed from the supposed parentage of this hybrid that it should be classed as a tangelo. The fruit, however, is sweet and not bitter, and more resembles an orange than a pomelo. From the general characters of this fruit it would be classed as a loose-skinned common orange, while the tangelo may be described in general as a loose-skinned pomelo. Some of the fruits of the Thornton have been affected with the orange scab to some extent, showing the susceptibility of the variety to this disease, as would be supposed from its similarity to the tangerine. As the fruits grow old they become rather large and puffy, as in the case of the tangerine, and it is a section of such an old fruit that is shown in the lower half of Plate XXI, which is not characteristic of the fruit when in prime condition. It is believed that the Thornton is a valuable fruit, and it should be tested thoroughly.

Pineapple Hybrids.

In the 1905 Yearbook of the Department five new varieties of pineapples were described, namely, the Miami, Seminole, Eden, Matthams, and Gale. Since that time a considerable number of the fruits of these varieties have been carefully tested, and a limited distribution has been made of slips of three of the varieties. The Miami has proven to be one of the best appearing fruits of the various hybrids, but, while of fairly good quality, it is much inferior to many of the hybrids in this regard. It is, however, apparently a good shipper, and, as its quality is certainly superior to that of the ordinary varieties of pineapples, it should prove a desirable sort. The Seminole and Gale produce fruits of exceptional appearance and very high quality; both of these varieties, however, produce but few slips and suckers and their propagation is thus very slow. This is the only important factor against the general cultivation of these varieties. The Matthams has proven to be an all round good sort. At the Graduate School of Agriculture, held at the University of Illinois in July, 1906, the writer had the pleasure of having a large number of these hybrids tested by the various students and instructors, fully fifty individuals taking part in the test. A vote on the quality of the fruits tested resulted in an almost unanimous vote in favor of Matthams for first, Eden for second, and Miami for third place. The Seminole and Gale were not fruiting in sufficient quan-

tity to be entered in this test, but about forty different hybrids were tested in comparison with Red Spanish. The Matthams is a yellow-fleshed variety of a rich sweet flavor, which on first testing is likely to be preferred by many people. The writer, however, believes it to be inferior in flavor to the Eden and to the Deliciosa, which is described later in this paper.

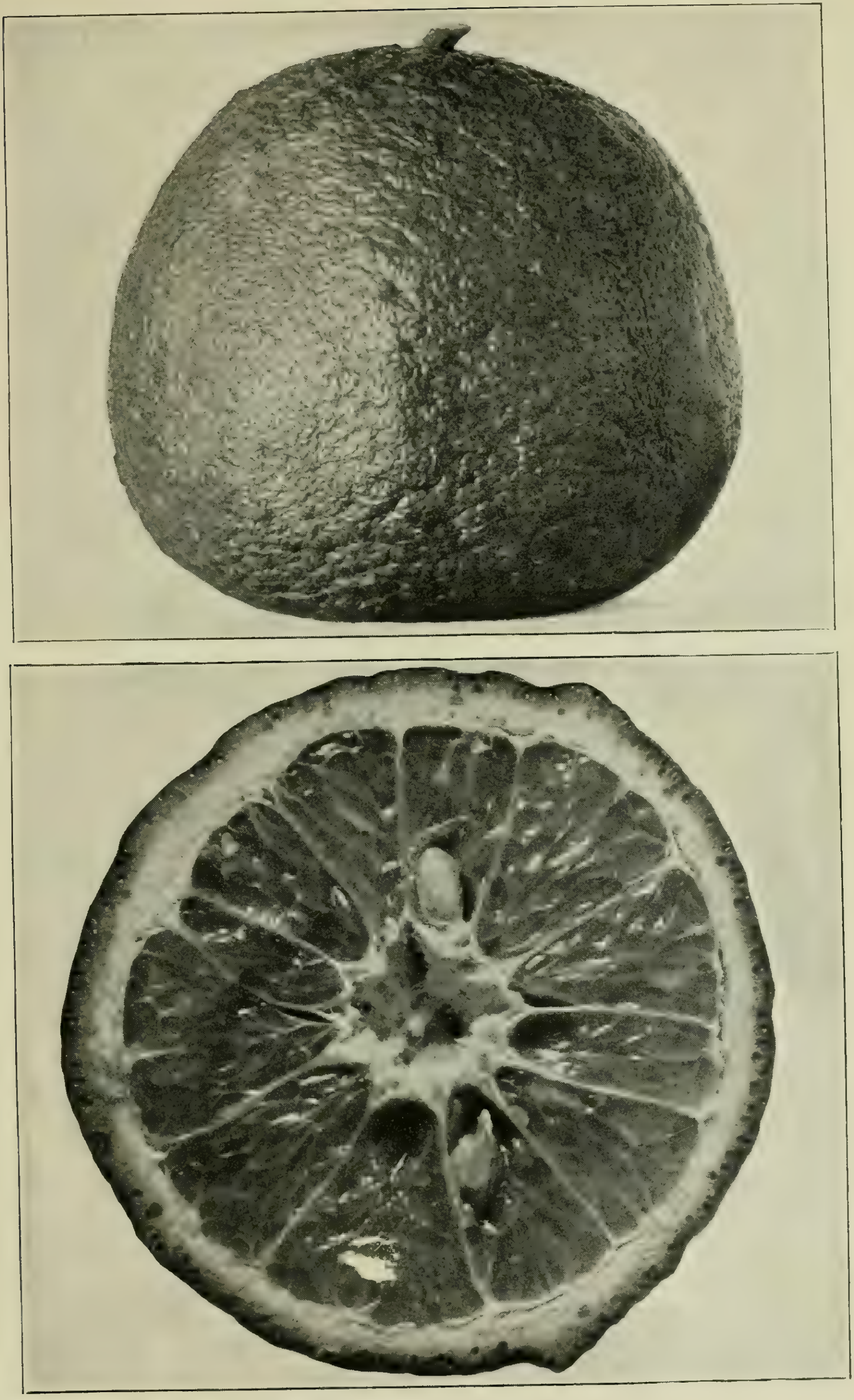
In the present paper 7 new varieties are described. These are all very distinct from any of the known varieties, and 6 of them have smooth-margined leaves; thus the experiments have resulted in adding 9 smooth-leaved varieties to our list, where only one smooth-leaved sort, the Smooth Cayenne, was known at the time the experiments were started. Since the experiments were started, however, a variation of the Red Spanish has gradually come into cultivation which has nearly smooth-margined leaves. Some of the leaves of this variation are still in parts serrate, but unquestionably a purely smooth-leaved sort can be established by the selection of slips from plants showing the least indication of spine development. The writer has been unable to learn the history of this smooth-leaved Red Spanish, but a considerable number of the fruits with smooth-leaved crowns can be observed in the market, so that it must be cultivated to a considerable extent. These fruits seem usually to be mixed with the spiny-leaved Red Spanish, as though the smooth-leaved type had not been distinguished as a distinct variety.

The writer wishes to strongly impress upon growers the desirability of only taking slips and suckers for propagation from those plants which have produced the finest appearing and best fruits. Several of the hybrids which are being named and distributed produce fruits which have certain characters that are variable, and some undesirable fruits may be produced. Some varieties occasionally produce too large crowns or compound crowns of undesirable shape. By propagating only from plants producing fruits with good crowns this tendency may probably be easily bred out. In the case of varieties such as the Orlando and the Biscayne, described later, in which a considerable number of the plants produce no slips, this tendency will doubtless be bred out in the course of their regular propagation, as the preponderating number of slips will be taken from prolific plants.

THE DELICIOSA PINEAPPLE.

[PLATE XXII, FIGURE 1.]

Pineapple hybrid No. 90, by all of those who have assisted the writer in testing hybrids, has come to be considered as the standard of excellence. Mr. W. A. Taylor, of Pomological Field Investigations, in describing this hybrid, said: "If any pine is entitled to the name Deliciosa, this is it." Following this suggestion, the writer has given the name *Deliciosa* to this hybrid.



THORNTON ORANGE. NATURAL SIZE.

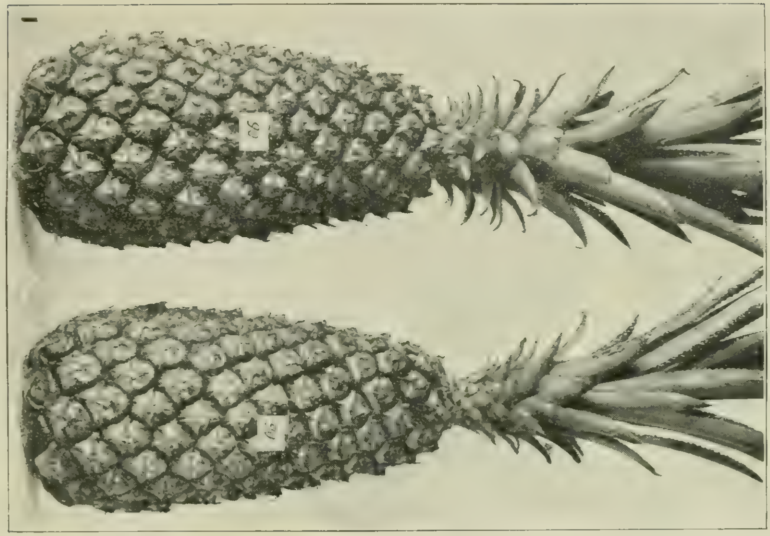


FIG. 1.—THE DELICIOSA PINEAPPLE. ONE-FOURTH NATURAL SIZE.

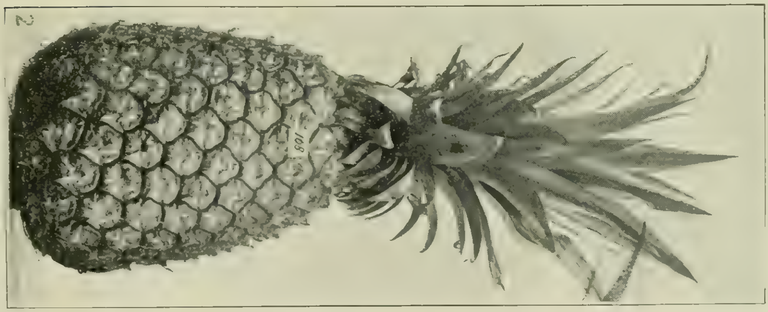


FIG. 2.—THE DADE PINEAPPLE. ONE-FOURTH NATURAL SIZE.

The Deliciosa is a hybrid of Enville with pollen of Porto Rico and is one of a series of 34 hybrids developed from seeds of the same fruit of Enville, a number of flowers of which were crossed by Mr. Swingle in the spring of 1897. The first fruit was produced in 1901, and since that time an increasing number of fruits has been produced each year. The Eden pineapple, described in 1905, is also one of this series of hybrids. A considerable number of the hybrids of this series are of remarkably high flavor. In the description of the Eden (No. 90) the Deliciosa was referred to as probably the best-flavored fruit, but rendered worthless for cultivation by its small size and very large crown. In the summer of 1906 a larger number of fruits of the Deliciosa have been produced than in any preceding year, and for some reason they have run considerably larger in size, while the crowns have been smaller. The writer interprets this change as occurring normally in the clon as it becomes older in bud-propagated generations. In several cases, at least, such changes in clons or bud-propagated varieties have been noted. In sugar cane, for instance, it has been found that the normal sugar content of a clon can not be determined until it has passed through several bud-propagated generations. It may be that this improvement in the fruits of the Deliciosa is due to better manuring and cultivation, but, whatever the explanation, it would seem that, if put under good conditions, the variety will produce a fruit of about 2 to 2½ pounds weight. At best, however, it is small and of poor shape, and, as in the case of the Eden, it is only its exceptionally high quality and flavor that justify its being named and distributed. In the case of both the Deliciosa and the Eden, however, it is believed that a special high-class market can be found for them, and in any case many growers will desire to cultivate a few of them for home use. A technical description of the Deliciosa pineapple follows:

Description of plant and fruit.—Plant usually large and spreading; leaves broad, recurved, rigid, dark green in color, and with a distinct central purplish stripe 1 inch wide; margin straight or somewhat undulate, serrate or spiny, with closely set medium-sized reddish spines; crown of medium to large size, mainly single but sometimes compound; average crown 8 to 9 inches high, with spread of 6 to 7 inches; appearance in general rather long and slender for shape of fruit; leaves of crown serrate, 4 to 10 inches long and from 1 to 1¼ inches wide; fruit small, usually weighing from 2 to 2½ pounds, conical in shape, being rather tall and diminishing gradually in size from bottom to top, height 5½ to 8 inches, diameter 3 to 4 inches; color of fruit in general orange yellow (by Ridgway's standards, fruits have been found to vary from deep chrome to orange ochraceous), the eye bracts frequently having a tinge of coral red; the color is often considerably hidden by a whitish scaly covering similar to the bloom of other fruits; surface of fruits rough; aroma usually strong and attractive; eyes small, averaging about five-eighths by five-eighths of an inch, similar to Enville in shape and considerably protruded; eye bracts medium in size, tip five-eighths of an inch long, with serrate margins frequently of coral or Indian red color; general quality of fruit excellent; texture very tender and brittle; flavor a very rich sweet subacid, very attractive; flesh light yellow or cream yellow, rather open; eye pits comparatively shallow; axis small, three-eighths to one-half inch in diameter, comparatively tender and brittle, in most fruits being of fair flavor and edible; slips numerous, usually from 3 to 10, rather too close to fruit; suckers 1 to 2; shipping quality apparently fairly good; season of ripening mainly between May 15 and July 1.

The Deliciosa is very different in character from either of the parents and it is difficult to trace any resemblance to the parental characters. The eyes are small and considerably protruded and the fruit is conical in shape. In these characters the Deliciosa most closely resembles the Enville, which was the mother parent. The very high flavor is also probably derived mainly from the Enville, though it is surely superior to the Enville in this regard. In no particular character can the influence of the Porto Rico be discerned and no one would suspect that the Porto Rico was one of the parents.

The Deliciosa is considerably different from its sister variety, the Eden, being smaller and of darker orange ochraceous color. The crown is larger in comparison to the fruit, but of the same general shape. The leaves are also more erect and not so broad as those of the Eden, and the edges are raised, the leaves resembling a gutter. The central stripe of the leaves is rather narrow and dark purple. The fruit, which is elongated and tapering, is carried on a long stem.

The Deliciosa is remarkable for its exceptionally delicate and delicious flavor and its tender, brittle flesh and core. It is not as juicy as some fruits, but is sufficiently juicy to be good. Its detrimental characters are its small size, poor shape for shipping, and rather large crown. By selecting slips for propagation from the largest, best-shaped fruits with small crowns, the variety can doubtless be much improved. As in the case of the Eden, the writer would recommend that the variety be cultivated for home use and gradually introduced into the market. If the superior quality of this fruit and the Eden for table purposes were recognized by the market they would be in great demand.

THE DADE PINEAPPLE.

[PLATE XXII, FIGURE 2.]

Pineapple hybrid No. 168, which has proven to produce a fruit of excellent quality, is believed to possess characters of merit, and for this variety the writer proposes the name *Dade*. This fruit is a hybrid of Enville with pollen of Smooth Cayenne. The cross-fertilized fruit which produced the Dade gave only 3 seedlings, Nos. 166, 167, and 168. No. 166, which is a serrate-leaved seedling, has already been discarded. No. 167, which is smooth-leaved like No. 168, is a fairly good variety and is still under trial. The Dade resembles the Enville in eye, size, and shape, and has the smooth-margined leaves like the Smooth Cayenne. The first fruits of this variety were produced in 1904, and since that time several fruits have been produced yearly. Following is a technical description of this variety:

DESCRIPTION OF PLANT AND FRUIT.—Plant medium to large, mainly rather spreading; leaves broad, recurved, rather rigid, green to dark green in color, and usually with a somewhat indistinct central purplish stripe about 1 inch wide; margin undulate, mainly smooth, but in some alternately smooth and spiny or simply with a few spines at the apex. Crown of medium to large size, single; average crown about 8 to 10 inches high, with spread of 6 to 8 inches, general appearance good; leaves of crown mainly

smooth, from 5 to 6 inches in length and from three-fourths to $1\frac{1}{4}$ inches in width, rather flaccid, with lower leaves rather long and frequently reflexed over apex of fruit; fruit of medium to small size, usually weighing from $2\frac{1}{2}$ to $3\frac{1}{8}$ pounds, ovate to conical in shape, height from 5 to 7 inches, diameter from $3\frac{1}{2}$ to $4\frac{1}{2}$ inches; color of fruit light lemon yellow or orange chrome; surface of fruit comparatively smooth; aroma attractive, spicy, fairly strong; eyes small to medium in size, similar to Enville in shape, flat and but slightly protruded; eye bracts small or medium in size, with slightly serrate margins; general quality of fruit excellent; texture tender and brittle, slightly stringy; flavor a sweet subacid with little or no acridity; flesh yellow, attractive in color, juicy, rather open; eye pits of medium depth; axis large, averaging about 1 inch in diameter, tender and brittle and of fair edible quality; slips numerous, usually 3 to 10, not too close to fruit; suckers 1 to 2; season late, the majority ripening in July.

The Dade pineapple is inferior to the Deliciosa in flavor, but is a better-shaped fruit, of good appearance, having mainly smooth-margined leaves. This variety, like a number of others of the hybrids where a spiny-leaved sort was crossed with the Smooth Cayenne, seems to be somewhat in doubt what sort of leaves to produce; frequently a leaf will be found which has scattered spines on the margin and occasionally a leaf will be almost wholly serrate. In general, however, it would be ranked as a smooth-leaved sort. The fruit is rather small for the size of the crown, but it has a bright, attractive color and good surface. It has some tendency to develop a fruit of slightly irregular shape, being in some cases slightly constricted in the middle. The plant is of good, vigorous habit, and the fruit stem is short and stout. Some fruits when received have been found to show some eye-rot, but the variety in general would probably ship well. On the whole the variety is probably not as promising as some others, but is worthy of careful trial under different conditions.

THE COQUINA PINEAPPLE.

[PLATE XXIII, FIGURE 1.]

To this pineapple hybrid No. 169 (Green Ripley crossed with pollen of Smooth Cayenne) has been given the name *Coquina*. It is the only seedling which developed from a single hybridized fruit, but is of the same parentage as the Gale, described in the 1905 Yearbook.

The seedling of the Coquina fruited first in 1902, and in 1905 a considerable number of fruits were produced. It adds another smooth-leaved sort to our list of promising varieties. The illustration of this fruit shown in Plate XXIII, figure 1, shows a poor fruit of the variety. A technical description follows:

Description of plant and fruit.—Plant large, compact or somewhat spreading; leaves broad, recurved, rather flaccid; color light green, mainly without a distinguishable central band, but in some specimens with an indistinct pale green band about 1 inch wide; margins mainly straight, but in some cases slightly undulate, smooth, or with a few serrations at the apex; crown of medium to large size, about 9 inches high and with spread of about 7 inches, single and usually of good shape and size in comparison with fruit; crown leaves 5 to 10 inches long and 1 inch wide, with smooth margins; fruit of good appearance, medium size, weighing from 3 to 4 pounds, oblong elliptical, $4\frac{3}{4}$ to $5\frac{3}{4}$ inches in height and from $4\frac{1}{4}$ to 5 inches in diameter. Color of fruit orange yellow (by Ridgway's standards deep chrome); eyes small to medium, somewhat irregular in shape, about medium in degree of protrusion; eye bracts of medium size, intermediate between smooth and serrate; flesh rather open, moderately juicy, of rich yellow color; texture brittle and solid, slightly stringy; flavor subacid, rich, sweet, attractive;

core small, one-half inch in diameter, tough and scarcely edible; eye pits shallow; aroma moderately strong and attractive; general appearance and quality excellent; slips 7 to 12; suckers 1 to 4; season mainly July.

The Coquina usually produces an attractive, good-sized fruit with good crown. The surface of some fruits has been slightly cracked and checked, but not sufficiently to seriously injure its good appearance. The flesh is of an attractive rich yellow color. The eyes in general resemble those of the Ripley, the female parent, while the crown and smooth leaves are mainly like the Smooth Cayenne. The variety produces a large number of slips and suckers, and may thus be rapidly propagated. In some fruits the slips are rather too close to the fruit, but seldom so close as to seriously injure the fruit in cutting or breaking it. While this fruit is not equal to some of the other hybrids in quality, it is believed to possess sufficient merit to justify its propagation.

THE JUPITER PINEAPPLE.

[PLATE XXIII, FIGURE 2.]

Pineapple hybrid No. 185 (Green Ripley crossed with pollen of Smooth Cayenne) has proven a very desirable sort in the tests made, and the writer has named this variety the *Jupiter*.

The Jupiter is one of a series of 20 hybrids developed from seed of the same original hybrid fruit. Many of these seedlings exhibit desirable characters, and one of them, the Gale, was described in the 1905 Yearbook.

Following is a technical description of the variety:

Description of plant and fruit.—Plant of medium to large size, spreading; leaves broad, recurved, rigid; margin of leaves mainly more or less undulate, and spineless or in some cases nearly spiny; color of leaves green, in most cases without central stripe, but occasionally showing indistinct purplish central stripe about 1 inch wide; crown single or sometimes compound, of medium size, averaging about 8 inches high with spread of 7 inches, of good appearance and symmetrical; crown leaves dark green, from 1 to 7 inches long and about 1 inch in width, margins smooth or serrate, and smooth intermingled; fruit of excellent appearance, medium in size, weighing from $2\frac{1}{4}$ to 5 pounds, ovate elliptical, from $5\frac{1}{2}$ to 7 inches in height and from $4\frac{1}{4}$ to 5 inches in diameter; color of fruit dark orange (by Ridgway's standards orange ochraceous); eyes of medium size, about three-fourths by seven-eighths inch, flat, giving a fruit of smooth surface; eye bracts small to medium in size, with smooth or slightly serrate margins; flesh solid, very juicy, yellow, and attractive in appearance; texture rather tough and slightly stringy, in some cases the fruits being recorded as tender, this character seeming to vary somewhat; flavor subacid and sweet; core rather large, 1 inch in diameter, tender and edible, at least in some fruits, recorded as tough in other fruits; eye pits shallow; aroma light but attractive; slips few, 1 to 2, sometimes none; suckers 1 to 2; season June and July.

The Jupiter is a rather peculiar hybrid in its variability when propagated vegetatively, and there is some possibility that it will prove too variable to give satisfactory results. Some of the fruits are of very excellent quality and appearance, while others are but little above the ordinary in these regards. Some fruits have the surface slightly cracked, but this in the fruits examined has not detracted seriously from the appearance. The foliage presents a peculiar intermixture of the spiny and smooth character of the two parental varie-

FIG. 1.—THE COQUINA PINEAPPLE. ONE-FOURTH NATURAL SIZE.

FIG. 2. THE JUPITER PINEAPPLE. ONE-FOURTH NATURAL SIZE.

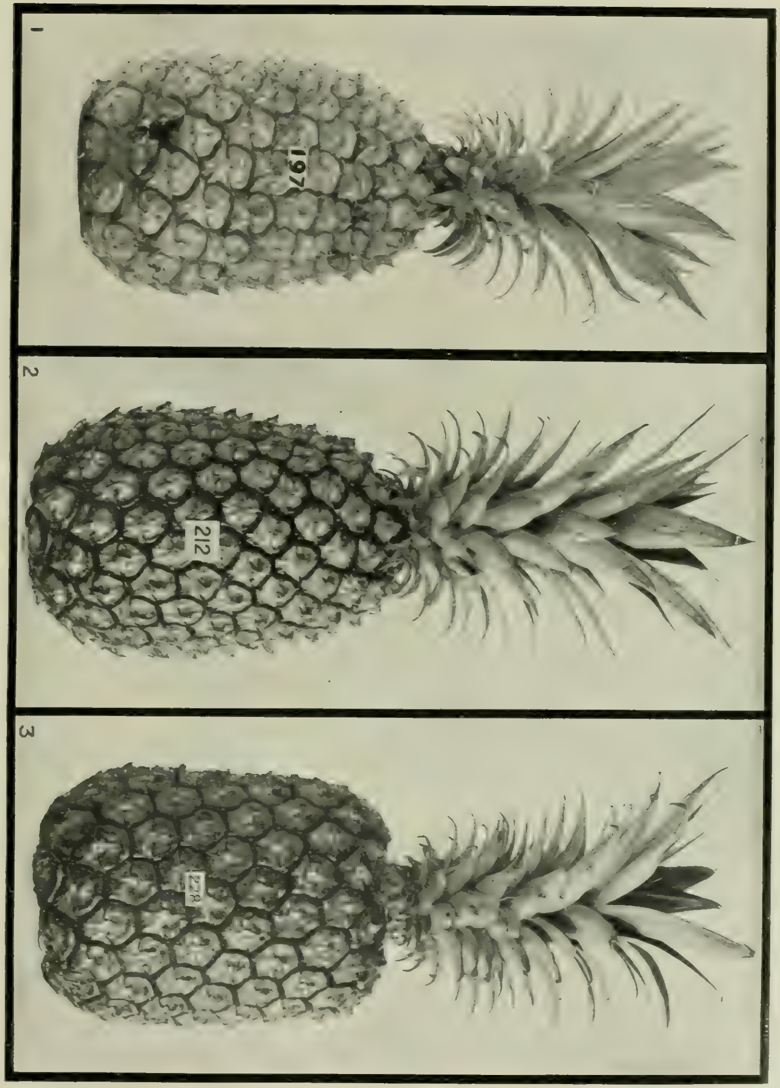


FIG. 1.—THE JENSEN PINEAPPLE. FIG. 2.—THE ORLANDO PINEAPPLE. FIG. 3.—THE BISCAYNE PINEAPPLE.

[All one-fourth natural size.]

ties. In general the leaves have smooth margins, but some leaves are spiny throughout, while others have scattered spines or groups of spines irregularly arranged on the margin, still others being spiny only at the apex.

The fruit of the Jupiter is, in general, about the same size and shape as the Red Spanish, being thus of good market size and shape. It is apparently a good keeper. This variety gives evidence of being a good canning sort, as it peels economically, and the core is soft enough in general, so that it probably can be sliced without cutting out the core. The solidity of the flesh and the sweetness of the variety also recommend it for this purpose. In flavor and quality the Jupiter is certainly inferior to a number of the hybrids, but it is superior in these respects to many of the varieties commonly cultivated.

THE JENSEN PINEAPPLE.

[PLATE XXIV, FIGURE 1.]

Pineapple hybrid No. 197 is a cross of Green Ripley with pollen of Smooth Cayenne. It is one of 24 seedlings grown from a single fruit of Ripley which was cross-pollinated in 1898. None of the other seedlings of this series has thus far proved valuable, and the majority of them have already been discarded. A few, however, are still under test. The first fruit of the Jensen was produced in 1902, and in 1905 and 1906 a considerable number of fine fruits were produced. A technical description of the variety follows:

DESCRIPTION OF PLANT AND FRUIT.—Plant medium to large, compact or somewhat spreading; leaves of medium width to broad, recurved, rigid; color green or light green, without central band or with an indistinct purplish band about 1 inch in width; margins more or less undulate, smooth or spiny at apex; crown single, of medium size, compact, 5 to 8 inches in height, with spread of from 4 to 8 inches, of excellent shape and appearance; crown leaves from 4 to 6 inches in length and from three-fourths to 1 inch in width, with smooth margins, frequently with very distinct purplish band; basal leaves in some fruits strongly reflexed over apex of fruit; fruit of excellent appearance, medium size, weighing from 2 to 4 pounds, oblong, conical, 5 to 6¾ inches in height and 3½ to 4½ inches in diameter; color light orange yellow, by Ridgway's standards yellow ocher to deep chrome; eyes of medium size, seven-eighths by seven-eighths inch, somewhat protruded or nearly flat, giving a good surface; eye bracts small or medium in size, with smooth or slightly serrate margins; flesh solid, very juicy, of rich yellow attractive color; texture very tender, soft, and stringless; flavor a rich, sprightly acid, very attractive, and with very little indication of acridity; core small, one-half to five-eighths inch in diameter, tender and edible; eye pits shallow; aroma fairly strong and attractive; slips usually about 5 or 6, in some cases rather too close to the fruit; suckers 1 to 2; season June and July.

The Jensen pineapple produces a very bright, finely colored, attractive fruit of good shipping size, with symmetrical crown. The eyes protrude but little, so that the surface is fairly smooth. In the eye character and in shape and size of fruit it is much like Ripley, the female parent, but fortunately it has inherited the smooth leaves of the male parent. While the fruits are solid and very juicy, the majority of them have reached Washington in excellent condition, with little sign of rotting. It is probable, therefore, that the fruits will be found to be fairly good shippers. On some there is a pronounced neck between the fruit and the crown, but this in no way

detracts from the excellent appearance of the fruit. The flavor of the Jensen is a sprightly acid, but it is nevertheless sweet, spicy, and of high quality. The flesh is remarkably juicy and tender and can be eaten very close to the surface. Withal, the Jensen is believed to be a very valuable variety, worthy of general cultivation. Because of its shallow eyes, solid, juicy flesh, and tender core it may also prove a good canning sort.

THE ORLANDO PINEAPPLE.

[PLATE XXIV, FIGURE 2.]

Pineapple hybrid No. 212, a cross of Green Ripley with pollen of the Smooth Cayenne, is one of the best appearing and most promising of the various sorts under trial. For this variety the writer proposes the name *Orlando*. The fruit of the Orlando is very different from either of the parental varieties or from any other of the known varieties. It has smooth, entire-margined leaves like the Smooth Cayenne, but differs from that variety in shape and size of fruit and in having much smaller eyes. In eye characters the Orlando somewhat resembles the Ripley, but could not be mistaken for that variety. The cross which resulted in the Orlando was made in the spring of 1898, and the first fruit was produced in 1903. Following is a technical description of the variety:

DESCRIPTION OF PLANT AND FRUIT.—Plants small to medium in size, compact or somewhat spreading, light green; leaves broad, recurved, rigid, mainly without central band, but occasionally with indistinct purplish or yellowish band about three-fourths inch wide; margin of leaves undulate, smooth, and spineless, or at least with only a few spines at the apex; crown single, of medium size and excellent appearance, 4 to 10 inches high, with spread of 4 to 8 inches; width of crown leaves three-fourths to 1 inch; fruit of excellent appearance, but rather small in size, weighing from 1 to 4½ pounds, and usually averaging about 2½ pounds, ovate oblong, 4 to 8 inches high and from 3 to 5 inches in diameter; color in general a bright orange (by Ridgway's standards between orange and orange ochraceous, with the base of the eye bracts ochraceous buff); surface medium in smoothness and attractive in appearance; aroma light but pleasant; eyes small to medium, three-fourths by three-fourths inch; in general flat or intermediate in degree of protrusion; eye bracts small to medium in size, with smooth margins; general quality of fruit excellent, very juicy, texture usually brittle and tender, with slight stringiness; flavor a rich, sweet subacid if not overripe, very pleasant and spicy, with very slight acridity; flesh yellow, solid; eye pits usually very shallow; axis small, averaging about three-eighths of an inch in diameter, usually rather tough and with little flavor, but in some fruits tender and edible; slips rather few, in some fruits 3 to 6, in others none; not too close to the fruit; suckers 1 to 4; season mainly June and July.

The fruit of the Orlando in general is very fine in symmetry, appearance, and all those characters which go to make up an excellent variety. The color is rich and attractive. In some fruits the eye bracts are somewhat cracked at the base, but this has in no case seriously detracted from the general good appearance. Some of the fruits are too small in size, but they are usually large enough to suit the market. In quality, the Orlando will rank very high if eaten before it is overripe. When the fruit ages, it is liable to become somewhat water-logged and too sweet to suit the majority of tastes. It is difficult to determine the season of a pineapple until it is

grown on a fairly large scale. The majority of the fruits of the Orlando have ripened in June and July, but some have been harvested in December. There is little waste to this variety, as the shallow eyes allow it to be peeled very thin. A feature of importance in connection with this fruit is the possibility, owing to its small size, of its being a desirable sort to use as the Natal variety is used in South Africa, according to the observations of Mr. D. G. Fairchild. There single fruits of the Natal are commonly purchased by pedestrians on the streets, peeled and eaten much as we eat apples in this country. The fruit of the Orlando peels without much waste, and is normally of small size. If the plants were grown considerably crowded together it is probable that numerous fruits of three-fourths to 1 pound weight could be produced, which, owing to their excellent appearance and smooth leaves, would be well adapted to use in this way. For such use they would probably be superior to the Natal, primarily because of their smooth leaves.

THE BISCAYNE PINEAPPLE.

[PLATE XXIV, FIGURE 3.]

Pineapple hybrid No. 228, a cross of Pernambuco with pollen of Porto Rico, is one of the finest appearing and best of the various hybrids with smooth leaves which have been secured by the Department of Agriculture, and has been named after the beautiful Bay Biscayne, on the shores of which it has been grown. The original crossed fruit from which the Biscayne developed gave 35 seedlings, 31 of which have fruited. Either the plants or the numbers of the other 4 were lost. Of these 31 seedlings, 21 have entire or smooth leaves, while 10 have serrate leaves. In this case both parents have serrate leaves, and it is difficult to account for the preponderating number of smooth-leaved plants among the hybrids. The proportion is exactly what would be expected in crossing a smooth with a spiny-leaved sort when the smooth character is dominant. It is difficult to understand how an error could have been made in the fruits, but the writer would be inclined to believe from the characters of the various hybrids that the Smooth Cayenne was used as the male parent instead of the Porto Rico. None of the other hybrids of this series has thus far been selected for propagation, though several of them are still under trial. The first fruit of the Biscayne was produced in 1902, and a considerable number of the fruits have since been grown and tested. Following is a technical description of the variety:

Description of plant and fruit.—Plant medium to large in size, spreading or somewhat compact, green or green suffused with purple; leaves broad, recurved, rigid, with purplish central band about 1 inch wide; margin straight or undulate; smooth or entire except for few spines at apex of leaves; crown single or compound, of medium size and usually excellent appearance, 3 to 6 inches high, with spread of from 4 to 6 inches; crown leaves usually rather narrow, from one-half to seven-eighths of an inch;

fruit of excellent appearance and medium size, weighing usually from 1½ to 4 pounds, oblong, 4½ to 7 inches high, and 3½ to 5 inches in diameter; color in general, orange (by Ridgway's standards ocher yellow, ochraceous, or deep chrome); surface smooth, regular, and very attractive in appearance; aroma mainly strong and spicy, in some fruits slight; eyes small to medium in size, five-eighths to seven-eighths of an inch by three-fourths to seven-eighths of an inch, flat, giving fruit very smooth appearance; eye bracts small, one-fourth to one-half inch long, with slightly serrate margins; general quality of fruit excellent, juicy; texture tender, slightly stringy; flavor a rich sweet subacid, very pleasing; acidity usually slight; flesh a cream yellow; attractive in appearance, solid; eye pits very shallow, fruit peeling with little waste; axis one-half to 1 inch in diameter, slightly woody, and with little flavor; slips 1 to 2, frequently none; suckers 1 to 3; season, June to July.

The Biscayne is somewhat similar in general characters and flavor to the Orlando. It is different in shape and appearance of surface, however, and is easily distinguishable from that variety when carefully compared. The crown of the Biscayne is frequently compound, and in some cases this detracts from the appearance of the fruits. In no case, however, has the crown been so large and compound as to injure the character of the apex of the fruit, and the compound nature of the crown has seldom detracted seriously from the appearance of the fruit. The surface of the fruit is particularly smooth, and even under these conditions the eyes are comparatively shallow. Ordinarily fruits with flat eyes have deep eye pits, while if the eyes are strongly protruded the eye pits are usually shallow. In shape the Biscayne is rather remarkable. No variety known to the writer retains in so marked degree its full diameter entirely to the apex. In almost all qualities the Biscayne is an excellent pineapple, and is believed to be worthy of general propagation.

DISTRIBUTION OF TUBERCULIN AND MALLEIN BY THE BUREAU OF ANIMAL INDUSTRY.

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IMPORTANCE OF EARLY DIAGNOSIS OF INFECTIOUS DISEASES.

In order to cope successfully with infectious diseases we must possess means for their early recognition, for, aside from the very great advantages which are thus obtained in cases where treatment is to be applied, an early diagnosis enables us to protect, by methods of quarantine and disinfection, healthy individuals that might otherwise be exposed to the contagion. Indeed, the success of any struggle with an infectious disease which is spread by contact of healthy individuals with those that are diseased may be measured directly by the certainty with which the disease in question can be recognized. This fact is obvious when it is remembered that infectious diseases are each caused by a specific micro-organism and that these micro-organisms are, in many diseases, discharged from the infected individual in large numbers. The longer the disease remains undiscovered the greater is the danger of the infection of other animals, which in their turn act as distributing agents for the virus.

Among the infectious diseases which affect cattle and horses, and which we are forced to combat chiefly by methods of quarantine, probably none cause greater losses in this country than tuberculosis of cattle and glanders of horses. It happens, also, that these two diseases are, in their early stages, among the most difficult to recognize, and this is especially true of tuberculosis. The onset is frequently insidious; the animal may remain apparently well when the disease is far advanced, and the infecting organisms may be discharged in large numbers, even though no lesion can be demonstrated by the usual clinical examination.

Under these circumstances it is indeed fortunate that for both tuberculosis in cattle and glanders in horses we possess specific diagnostic agents to aid and supplement the clinical examination. These diagnostic agents, which are known as tuberculin and mallein, are derived from the bacteria which cause the two diseases, and are now regarded as indispensable in any attempt to eradicate these diseases if a successful result is to be attained.

In order that the mode of applying these substances in dealing with tuberculosis and glanders may be more readily understood, it may be well to relate briefly the history of the discovery of tuberculin and mallein, and the manner of fighting disease by their use.

TUBERCULIN AND ITS USE.

As is now quite generally known, Prof. Robert Koch, in the year 1890, first recommended the use of a solution prepared from pure cultures of the tuberculosis bacillus for the treatment of tuberculosis. All live bacilli in glycerinated bouillon cultures of this bacillus were first destroyed by heat and removed by filtration. The filtrate, evaporated to a small bulk, constituted the tuberculin and consisted of the soluble and noncoagulable portions of the culture medium, together with those products of the growth of the tubercle bacilli and those portions of the bacterial cells which were likewise soluble and not coagulable by heat.

Professor Koch observed that minute quantities of this tuberculin, injected under the skin of tuberculous animals, exercised a specific stimulating action upon the tuberculous foci and at the same time produced a systemic reaction, which was characterized by a marked rise in temperature a few hours after the injection. Tuberculin was originally thought to possess unusual value as a curative agent. Although Professor Koch's expectations in this respect were not borne out by numerous practical tests, his discovery had a far-reaching influence upon the very futile struggle which had hitherto been waged against tuberculosis in cattle; for hardly had his discovery been announced before the specific reaction produced in tuberculous individuals by tuberculin was recognized as a possible means of diagnosis in obscure cases of bovine tuberculosis.

Experiments to determine the value of the use of tuberculin for this purpose were begun immediately by veterinarians in all parts of the world, and the literature of the past fifteen years is filled with the records of their work. Without attempting to review these experiments in detail, it may be stated that while some have reported adversely upon the use of tuberculin as a diagnostic agent, the failures were, in many instances, due to a faulty application of the test or to improper interpretations of the results obtained. There appear to be two possible sources of error in connection with the tuberculin test: (1) Apparent reactions in healthy cattle and (2) a failure of tuberculous cattle to react to the test.

In regard to the first-mentioned possibility, the best authorities are agreed that this source of error is exceedingly small, if, indeed, it exists at all. Nocard, the eminent French authority, has stated that a positive tuberculin reaction is absolute proof of tuberculosis, and if a post-mortem examination fails to reveal tuberculosis we have

evidence not of the inexactness of tuberculin, but of its extreme delicacy in revealing lesions which are too minute to be discoverable by the ordinary methods of post-mortem examination.

On the other hand, experience has shown that a very small percentage of tuberculous cattle may fail to react to the test, though this is not a serious objection, for the reason that the failures of this kind are usually observed in advanced cases of the disease, which can be readily recognized by the ordinary physical examination. It is a curious fact that cattle which are affected with tuberculosis in an exceedingly slight degree may exhibit much more pronounced reactions than others which are extensively diseased.

There can be no doubt that the tuberculin test is a remarkably accurate means of detecting tuberculosis in cattle, and the methods employed for ridding a herd of this disease without destroying even the affected animals will be readily understood. In the early days of the application of the test it was the common practice to test the entire herd and then to destroy all reacting animals. This has been found to be in most cases unnecessary and undesirable unless the number of reacting cattle is small and the animals not of particular value. The practice most generally followed is known as the "Bang method" of dealing with tuberculosis, so named after the originator of the system. By this method the entire herd from which tuberculosis is to be eradicated is subjected to the tuberculin test. All of the animals which fail to react are immediately removed to new quarters and kept entirely separate from the reacting animals of the herd. The latter may be fattened and slaughtered subject to post-mortem examination, or they may be used for breeding purposes if they are high-grade stock. Tuberculosis is extremely rarely transmitted from parent to offspring, and if calves of tuberculous cows are removed from their mothers immediately after birth they may be placed with the healthy portion of the herd and fed with boiled milk from the tuberculous cows or raw milk from the healthy cows. Within six months or a year the healthy portion of the herd should be retested and the reacting animals, which will probably be comparatively few, should be immediately removed from the healthy ones as in the first instance. If this system be carefully followed, with regular retests of the non-reacting portion of the herd, tuberculosis can be eradicated within a few years at comparatively small cost to the owner and with a tremendous gain in the productiveness of the herd. It has been quite definitely proven that tuberculin does not injure healthy cattle, nor does it render the milk unwholesome.

MALLEIN AND ITS USE.

The methods used for preparing mallein and the manner of applying this test for glanders are quite similar to those used in the case of

tuberculin. In fact, the use of mallein was a direct outgrowth of the experiments made with tuberculin. The bacillus of glanders (*Bacillus mallei*) is grown in pure culture upon artificially prepared media and the soluble noncoagulable portions of the bacterial growth are extracted. This extract is preserved by means of some suitable antiseptic and is injected subcutaneously into horses suspected of being affected with glanders. The reaction obtained in diseased horses is of the same general nature as that obtained by injecting tuberculin into tuberculous cattle, though there are certain differences observed in the form of the fever curve. In horses reacting to mallein there is also usually a marked swelling of the tissues around the point at which the mallein was injected. This swelling, which does not occur in tuberculous cattle after a tuberculin injection, is one of the characteristic features of the reaction of glandered horses to mallein.

In regard to the reliability of the mallein test, it must be acknowledged that, although a reaction to mallein or a failure to react is generally a correct indication of the existence or nonexistence of glanders, the results of this test can not be accepted with the same assurance that follows a properly applied tuberculin test. There have been cases in which apparently typical reactions were obtained with mallein, although the horses tested exhibited no symptoms whatever of the disease; and likewise failures have been recorded in what appeared to be undoubted cases of glanders.

It is the general opinion, however, among those who have had experience in the practical use of mallein, that it is a very valuable aid in the diagnosis of glanders, and it seems not unreasonable to hope that improvements in the present technique employed in making this test, together with a fuller knowledge of the mechanism of the reaction, will eventually produce even more trustworthy results than those now obtained.

In combating glanders the general practice is to destroy horses which are positively known to be affected with the disease and to quarantine those which are merely suspected of being affected.

MANNER OF DISTRIBUTING TUBERCULIN AND MALLEIN.

In order to be in a position to enforce more effectively its quarantine regulations, the Bureau of Animal Industry began in the year 1893 the preparation of both tuberculin and mallein, and it was decided at the same time to supply these substances free of charge to properly constituted health officers and official veterinarians in the various States and Territories. This distribution was undertaken for the purpose of cooperating with State officials in their efforts to restrict and eradicate these infectious diseases under authority conferred upon the Secretary of Agriculture by act of Congress.

This distribution is restricted to Federal, State, county, or city officials, who are supplied with tuberculin and mallein upon their

agreeing to furnish the Bureau of Animal Industry with records of all tests and with the results of the autopsies on all animals that are slaughtered, and upon the further understanding that all tests shall be conducted under their supervision by practitioners who are skilled in the use of tuberculin and mallein. In addition to furnishing tuberculin to the above-mentioned officials, considerable quantities have been sent to inspectors of the Bureau of Animal Industry stationed at various places along the Canadian border and at other points where cattle are offered for importation without the required certificates of freedom from tuberculosis. In order to carry out more effectively the plan to exclude tuberculous cattle from this country, an inspector of the Bureau is stationed in England, and there tests all cattle intended for export to the United States and refuses certificates to those found to be diseased.

As was to be expected, in the first few years after the preparation of tuberculin and mallein was undertaken by the Bureau of Animal Industry comparatively small quantities were sent out. But the demand for these substances has steadily increased, this increased demand being especially noticeable during the last few years. In the fiscal year ended June 30, 1906, somewhat more than 103,000 doses of tuberculin and 10,000 doses of mallein were supplied to officials in different States and Territories, as follows:

Distribution of tuberculin and mallein in the year ended June 30, 1906.

Distributed to—	Doses.		Distributed to—	Doses.	
	Tuberculin.	Mallein.		Tuberculin.	Mallein.
Alabama	....	12	Nebraska	14	....
Arizona	24	151	New Jersey	1,668	....
Arkansas	....	12	New Mexico	78	75
California	754	252	New York	161	....
Colorado	168	....	North Carolina	1,256	12
Connecticut	....	5	North Dakota	2,944	869
District of Columbia	619	5	Ohio	1,300	192
England	600	....	Oklahoma	60	78
Georgia	130	....	Oregon	731	12
Hawaii	....	516	Pennsylvania	50	....
Illinois	120	2	Porto Rico	....	325
Indiana	221	54	Rhode Island	30	6
Iowa	2,067	272	South Carolina	6	24
Kansas	344	12	Utah	734	68
Maine	1,696	....	Vermont	19,674	84
Maryland	288	....	Virginia	139	....
Massachusetts	19,385	....	War Department	....	1,612
Michigan	912	45	Washington	4,502	708
Minnesota	26,582	4,110	Wisconsin	12,936	....
Missouri	1,810	20	Total	103,510	10,105
Montana	1,304	572			
Mississippi	203	....			

The legislatures of a number of the States in the above list have passed laws requiring that all cattle which enter these States shall either present a proper certificate of freedom from tuberculosis or else pass the tuberculin test at the time they enter the State; in addition, tests of herds within the State which are suspected of being affected with tuberculosis are also provided for. These tests are usually conducted by a live-stock sanitary commission or by the State board of health, and are compulsory in some States and made upon request in others. In many of the States having specific laws covering this subject the reacting cattle are slaughtered subject to post-mortem inspection and the owner is paid a certain percentage of the appraised value of the condemned animals. Similar regulations are in force concerning glanders. In addition to supplying these State boards, the Bureau furnishes a considerable quantity of tuberculin to city officials whose duty it is to detect tuberculosis in the dairy herds from which the city's milk supply is derived.

RESULTS OF THE DISTRIBUTION.

The results achieved by the distribution of tuberculin by the Bureau of Animal Industry are best appreciated by referring to the reports of the several State boards that have had supervision over the use of tuberculin supplied them by this Department. These officials have received from the Department in the last ten years, in round numbers, 500,000 doses of tuberculin. This tuberculin has been used almost exclusively for testing dairy cattle, and the reports show a percentage of tuberculosis in these herds which varies from 1 to 80 per cent, or even more in some instances. The average percentage of tuberculosis in dairy herds revealed by these tests certainly falls very little, if any, below 5 per cent of the whole number tested. In the vast majority of cases the diseased animals have been removed from the herds, either by quarantine or by slaughter. It appears, therefore, that not less than 25,000 tuberculous cattle have been removed from our dairy herds through the agency of this governmental distribution of tuberculin. The great gain which must ultimately result to the owners of the herds from which these infectious individuals have been removed is seen in reports of retests of herds which were found highly tuberculous upon the first examination. All reports bearing upon this subject show that the number of reacting animals in the second test was very small—at times none—and the owners are thus being enabled to rid their herds of the most serious menace which confronts them.

Nor are the benefits derived from this work to be measured by an economic standard only, for an even more important object is being attained—the protection of the public health. The consensus of scientific opinion now is that bovine tuberculosis is transmissible to

man, and it is an undoubted fact that tuberculous cattle frequently discharge tubercle bacilli from their bodies through their milk, even though no demonstrable lesion of the udder exists.

Any tuberculous cow may therefore be a source of real danger to the people who partake of her milk, and in the case of large dairies, where the milk from the whole herd is usually mixed together before being distributed to the consumers, a few tuberculous cows may cause the contamination of large quantities of milk. This mixing together of milk serves to distribute the infective bacilli through all of the dairy products, thereby increasing greatly the number of persons exposed to the infection. The good which has been accomplished by the removal of the 25,000 tuberculous cows from dairy herds in this country is thus seen to be much greater than would be at first supposed, for it is probable that the milk from at least five times as many cows has been rendered wholesome by the removal of these distributers of the tuberculosis virus.

The good which has resulted from the distribution of mallein can not be so readily determined, but it can not be doubted that the destruction of the many glandered horses which have reacted to the mallein test has protected many others from the infection. And in the case of glanders the diseased horse is not only a menace to others belonging to the same owner, but to horses that are exposed to infection through the agency of the public drinking troughs which are maintained in most of our cities.

Quite apart from this distribution of mallein to civilian authorities must be considered the supplies which have been furnished the War Department. The Bureau of Animal Industry has been ready at all times to furnish mallein to that Department, and upon the request of the Quartermaster-General has sent out many thousand doses. During the war with Spain large quantities of mallein prepared in these laboratories were used for testing the horses and mules purchased for the use of the Army, and the facilities for preparing mallein are such that large supplies are always available.

It is hoped and believed by the Department that, in addition to the actual benefit derived by stock raisers from the tests which have been carried out, the educational value of the work has been of great advantage to stock-raising communities. For it is reasonable to suppose that a dairyman who has once had his herd freed from tuberculosis will not knowingly again introduce the disease among his cattle. He will insist upon a tuberculin test of all animals which are purchased, and this demand on the part of the purchaser for healthy cattle will force upon breeders and raisers the necessity of supplying them.

It seems not unreasonable to believe that if this testing of cattle for tuberculosis could be carried out on a sufficiently large scale, and if it were in all cases followed up by careful and intelligent quarantine measures with periodical retests of the herds, the percentage of tuberculous cattle could at least be reduced to a very small fraction of that which is now known to exist. If tuberculosis can be eradicated from one herd the same can be done for others. The whole question would seem to be simply one of organization and cooperation between the Federal and the local authorities and the stock raisers themselves.

PROMISING NEW FRUITS.

By William A. Taylor,
Pomologist in Charge of Field Investigations, Bureau of Plant Industry.

INTRODUCTION.

The question as to what varieties of fruits and nuts to plant is one that confronts the orchardist when he contemplates an increase of his orchard or vineyard. Requiring a more or less permanent investment of capital in the form of land and labor, as well as cost of nursery stock, it is essential that he choose such varieties as shall not only be adapted to his climatic and soil conditions, but also to the markets or uses for which their products are intended. The desires and needs of consumers change as time rolls on, so that sorts that were once profitable cease to be so, even though they do not deteriorate in any way; hence continual attention by the grower to the new sorts that come to notice is advisable. A few of the more promising new varieties for cultivation in different sections of the country are described and illustrated here in continuation of the series begun in the Yearbook for 1901 and contributed yearly since that time.

MAGNATE APPLE.

(Synonyms: *Magnet* of some; *Stayman's Superior; Stayman's No. 1* of some; *Stayman's No. 2* of some.)

[PLATE XXV.]

This promising early winter variety is a seedling of Winesap which originated with the late Dr. J. Stayman, at Leavenworth, Kans., in 1866.[a] After the original tree came into bearing it appears to have been considerably disseminated by the originator, in the form of scions for testing, from about 1884 until his death, in 1903. While a number of descriptions and outlines of the variety made by Doctor Stayman are preserved in the extensive collection of such material bequeathed by him to the Department of Agriculture, it is apparently impossible at this time to determine under what designation the variety was first disseminated.

It appears to have reached Mr. J. W. Kerr,[b] Denton, Md., in the winter of 1884–85 under the designation "Stayman's No. 1" with others of Doctor Stayman's seedlings in the form of scions from

[a] MS. notes of Dr. J. Stayman in Pomological Collections, Bureau of Plant Industry.

[b] Letters from J. W. Kerr, December, 1906.

J. Silvanus Gordon, of Sergeantsville, N. J. Mr. Gordon had received the scions from Doctor Stayman a short time before.[a] About 1887 it reached the nursery of the Michigan Agricultural College,[b] apparently direct from Doctor Stayman, under the same designation. In 1890[c] Mr. Benjamin Buckman, of Farmingdale, Ill., received scions of it from the Michigan Agricultural College orchard labeled "Stayman's No. 1," and in 1893 under the designation "Stayman's Superior" he received scions direct from Doctor Stayman. Having fruited both and finding them identical, in 1901 he sent specimens of the fruit to Doctor Stayman for authentication of name, and received from him a strong expression of his conviction[d] that the apple sent was in fact his "Stayman's No. 2." The original tree is reported by Mr. George H. Black, its present owner,[e] to be living still, though it was almost destroyed by a severe windstorm in September, 1905. Messrs. Stayman and Black propagated a considerable number of trees of it for their own planting in the winter of 1897–98 at Leavenworth, Kans., where some seventy trees about 6 years old are now in bearing.

The earliest publication of the variety appears to have been by Prof. L. H. Bailey in 1887,[f] when, as "Stayman's No. 1," it was included with several others of Doctor Stayman's seedlings in a list of varieties growing at the Michigan Agricultural College. In 1896 Mr. Benjamin Buckman published the names "Stayman's Superior" and "No. 1 Stayman's" in his "List of Fruit Varieties,"[g] their identity not having been discovered at that time. The first commercial introduction of the variety appears to have been by Mr. J. W. Kerr, who catalogued it for the fall of 1898 and spring of 1899 as "Stayman No. 1."

It is evident from Doctor Stayman's notes and correspondence that at different times he had different names for the variety under consideration, such as "Red Sap," "Stayman's Superior," "Magnet," and "Magnate," and it appears strongly probable that scions were distributed by him for testing under all these names, as well as under the designations "No. 1" and "No. 2." His final choice appears to have been "Magnet,"[h] but conflict of this with a previously published variety[i] of Wisconsin origin causes the present

[a] Letter from J. Silvanus Gordon, December, 1906.

[b] Letters from Prof. L. R. Taft and Prof. L. H. Bailey, December, 1906, and January, 1907.

[c] Letters from Benjamin Buckman, December, 1906.

[d] Letter of Dr. J. Stayman to Benjamin Buckman, October 3, 1901.

[e] Letter of George H. Black, January 12, 1907.

[f] Michigan Agricultural College Bulletin 31, 1887, p. 54.

[g] List of Fruit Varieties in Private Experimental Orchard of Benj. Buckman, Farmingdale, Ill., fall 1896, pp. 4–5.

[h] Letter of Dr. J. Stayman to Benj. Buckman, December 17, 1900.

[i] Minnesota Agricultural Experiment Station Report, 1890, p. 36.

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MAGNATE APPLE.

adoption of his previously unpublished name "Magnate," under which it was planted in nursery and orchard by Messrs. Stayman and Black. The Magnet apple listed in Bulletin 56 [a] of the Bureau of Plant Industry is the Wisconsin variety, and the publication of "Stayman Superior" as synonymous with it in the revised edition of that bulletin [b] appears to have been due to a misapprehension as to its identity.

DESCRIPTION.

Form round to roundish conical; size medium to large; surface smooth, but gently undulating and glossy; color rich yellow, washed with crimson over almost the entire surface and indistinctly striped with dark purple and covered with whitish bloom; dots variable in size, numerous, yellow or red; cavity regular, large, deep furrowed and but faintly russeted; stem slender, curved, short, rarely extending beyond the cavity; basin regular, of medium size and depth, and gradual slope, furrowed, and showing traces of bloom; eye medium, closed; calyx segments of medium size, converging, tube rather long and narrow; skin moderately thick, tenacious; flesh yellowish, stained with red, fine-grained, half tender, juicy; core small, conical, closed, clasping; seeds of medium size, plump, brown, numerous; flavor rich subacid; quality very good. Season, September to December in eastern Kansas, about the same as Jonathan.

The tree is reported to be an upright open grower, loaded with wiry shoots, and requiring little pruning. The variety appears to be especially promising for the middle and northern portions of the region where its parent, the Winesap, succeeds.

The specimen illustrated on Plate XXV was grown near Leavenworth, Kans., in 1906.

OLIVER RED APPLE.

(SYNONYMS: *All-Over Red; Oliver; Oliver's Red; Senator.*)

[PLATE XXVI.]

One of the striking features of the Arkansas fruit exhibit at the World's Columbian Exposition in Chicago in 1893 and the Cotton States Exposition at Atlanta in 1895 was a brilliantly colored red apple conspicuously marked with large light dots. It had then been grown for many years in certain localities in Washington County, Ark., both in orchards and nurseries, under the name *Oliver's Red*, and according to some accounts as *All-Over Red*. It does not appear to have been known outside of the Ozark region until after it was exhibited with other Arkansas apples at Chicago.

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[a] B. P. I. Bulletin 56, Nomenclature of the Apple, January 25, 1905, p. 189.

[b] B. P. I. Bulletin 56, Nomenclature of the Apple, revised July, 1905, p. 393.

As nearly as can be ascertained, this variety originated early in the nineteenth century [a] on the John Oliver farm, 7 miles south of Lincoln, in Washington County, Ark. It was first propagated by Earles Holt about the middle of the century, who grafted it on a place 2 miles north of Lincoln, where it has been locally known and propagated ever since that time under the name *Oliver's Red*. At various times one or two other seedlings appear to have been somewhat confused with it, but at the present time no other sort is recognized in the locality under that name. In 1898 Prof. John T. Stinson [b] described it under the shortened name *Oliver*, but this had previously been published [c] for a very different sort.

Since 1895 the variety has been quite widely disseminated by the Stark Brothers Nurseries and Orchards Company under the name "*Senator*," which was registered by them in the United States Patent Office on November 22, 1898, as a trade-mark. In view of the fact that the earlier name had been well established for half a century in the region where it originated and continues to be practically the only name known for it there, that name, Oliver Red, is here accepted as the one to which the variety is entitled under the code of nomenclature of the American Pomological Society.

DESCRIPTION.

Form oblate to roundish oblate; size medium to large; surface smooth and glossy, excepting occasional russet knobs and numerous russet dots; color deep yellow, washed over most of the surface with bright mixed red and brokenly striped with dark crimson; dots very conspicuous, russeted, mostly aureole; cavity large, regular, deep russeted; stem short, rather stout; basin large, deep, regular, gradual, slightly furrowed; eye large, closed; calyx segments of medium size, converging, tube very short and broad; skin moderately thick, tenacious; flesh yellowish, frequently stained, moderately fine grained, breaking, juicy; core medium, conical, open, meeting the eye; seeds medium in size, plump, brown; flavor subacid, pleasant; quality good to very good.

The tree is a strong, upright grower, somewhat subject to sun scald unless headed low, but coming into bearing at an early age and bearing well. It is a choice dessert apple, well adapted to fancy trade, and worthy of testing throughout the important apple districts of the country.

The specimen illustrated on Plate XXVI was grown in 1906 by G. W. Collins, Lincoln, Washington County, Ark.

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[a] Letters of Wm. G. Vincenheller, December, 1906, and M. D. Holt and G. W. Collins, Lincoln, Ark., January, 1907.

[b] Arkansas Agricultural Experiment Station Bulletin 49, January, 1898, p. 16.

[c] Magazine of Horticulture, 1853, p. 165.

D. G. Passmore

OLIVER RED APPLE.

A. A. Newton

RABUN APPLE.

RABUN APPLE.

(SYNONYMS: *Rabun Bald; Rabun Ball*,[a] through typographical error.)

[PLATE XXVII.]

One of the most promising new apples for the lower Appalachian region, comprising western North Carolina, eastern Tennessee, and northern Georgia, is the Rabun. Its history as furnished by Prof. C. C. Newman,[b] of Clemson College, S. C., is substantially as follows:

The original tree was found about 1890 by Mr. Andy Hanby in clearing land on his place on the Walhalla and Franklin wagon road, about 13 miles northeast of Clayton, Ga., where it still stands. It was small when found, and is thought by Mr. Hanby to have been about 5 years old at that time. About 1900 Mr. Hanby dug up eight young sprouts about the parent tree and planted them elsewhere, all of which are now in bearing and are identical with the parent tree. Fruit from the original tree was exhibited at the Georgia State Fair in 1904 and 1905 under the name "Rabun Bald," which was suggested by the location of the tree, which is on a spur of Bald Mountain. It has since been locally known under this name, which is here reduced to Rabun to conform to the code of nomenclature of the American Pomological Society. It was first described and illustrated by Prof. C. C. Newman [c] in 1905 in Bulletin 9 of the South Carolina Agricultural Experiment Station. Some 2,500 trees of this variety have been planted at Clayton, Ga., but aside from this it does not appear to have been commercially disseminated.

DESCRIPTION.

Form oblate, slightly ribbed; size large; surface smooth; color yellow, washed with mixed red, splashed and striped with bright crimson; dots numerous, small, russet; cavity large, regular, deep, russeted; stem short, stout; basin regular, large, deep, of gradual slope, furrowed; eye medium to large, closed; calyx segments medium, converging, reflexed at tip, tube long, flaring; skin moderately thick, tenacious; flesh yellowish, fine-grained, breaking, juicy; core large, oblate, open, clasping; seeds medium, plump, brown, very numerous; flavor subacid; quality good to very good. Season, November to March in northern Georgia.

The tree is described as a stocky, vigorous grower, of spreading habit, requiring severe pruning when young. The bearing habit is distinctive in that the fruit is largely borne on spurs along the older branches, the crop being thus quite evenly distributed throughout the

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[a] South Carolina Agricultural Experiment Station Bulletin 9, May, 1905, p. 24.

[b] Letters of C. C. Newman, January, 1907.

[c] South Carolina Agricultural Experiment Station Bulletin 9, p. 24.

tree. The original tree is a heavy cropper in alternate years, bearing about a half crop in the "off year." It yielded 15 bushels in 1905.

The specimen illustrated on Plate XXVII was grown in 1905 by Prof. C. C. Newman, at Clayton, Rabun County, Ga.

EARLY WHEELER PEACH.

(SYNONYMS: *Wheeler Cling; Early Wheeler Cling.*)

[PLATE XXVIII.]

The lengthening of the peach season through the origination of both earlier and later varieties of good quality is a matter of much importance to peach growers, especially in the Southern States. At the present time so large a proportion of the trees in southern orchards consists of the one variety, Elberta, that almost the entire peach crop of each important locality must be harvested and marketed within a period of ten days or two weeks. This causes serious labor shortage at the critical times, overburdens transportation facilities, and tends to produce that most expensive menace to profitable peach growing, a glutted market. If the weather conditions chance to be unfavorable during this short harvest period, the evils are accentuated and most of the returns for the year's work are not infrequently lost through the shortness of the marketing season. Peach growers and nurserymen have long recognized the need of earlier market varieties, and a large number of early sorts have been brought into notice from time to time. Among these the Greensboro, Carman, Waddell, Mamie Ross, and Hiley varieties have attained a more or less stable foothold in different sections as commercial sorts.

Most of the varieties earlier than these, however, unless grown under very favorable conditions, are of inferior flavor and deficient carrying quality. The Early Wheeler, which was one of a large number of seedlings of Heath Cling grown by Mr. E. W. Kirkpatrick, of McKinney, Tex., and first fruited in 1900, appears to be an exception in these respects, being as early as Alexander, as large as Mamie Ross, and of as excellent dessert and shipping quality as Oldmixon Cling. It was experimentally disseminated by Mr. Kirkpatrick immediately after it first fruited, being sent out as Early Wheeler Cling. About 1903 this was reduced to Early Wheeler, and on April 17, 1906, an arbitrary device bearing this name and a portrait of the originator was registered in the United States Patent Office as a trade-mark by the Texas Nursery Company, of Sherman, Tex., which introduced it commercially in that year.

DESCRIPTION.

Form roundish oblong to oblong conical; size medium to large; cavity regular, large, broad, of medium depth and slope, marked with red; stem short, moderately stout; suture shallow except near

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EARLY WHEELER PEACH.

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BANNER GRAPE

cavity, from which it extends to the protruding apex; surface smooth, covered with loose, soft, velvety down; color creamy white, marbled, splashed and dotted with crimson; skin moderately thick, tenacious; flesh whitish, distinctly stained with red near the skin, firm and meaty, but juicy; stone oval, of medium size, adherent; flavor subacid; quality good to very good. Season, very early, May 15 to June 1, practically with Alexander in northeastern Texas. Leaf glands reniform; blossoms very large and red.

The variety has already been considerably planted in commercial orchards in eastern Texas, and while less precocious than some sorts, is considered sufficiently productive for a commercial variety.

The specimen illustrated on Plate XXVIII was grown by E. W. Kirkpatrick, at McKinney, Tex.

BANNER GRAPE.

[PLATE XXIX.]

This very promising variety for the Southwest is said by its originator, Mr. Joseph Bachman, Altus, Ark.,[a] to have been grown in 1898 from seed of Lindley crossed with Delaware. It would appear from the vigor and productiveness of the vine and the large size of the cluster, however, that some other variety, probably one of his other seedlings that stood near by, was concerned in the cross, and the originator appears to incline to this opinion, as he states that the Lindley blossoms were not protected from other pollen at the time of pollination with Delaware.

The original vine bore a crop of twelve clusters in its third year, 1901. Two of these were exhibited by the originator at the Pan-American Exposition in that year under the name Banner, which the late Judge Samuel Miller published for the variety in a communication in Colman's Rural World for September 18, 1901. The variety was first propagated in 1902, and was experimentally disseminated in the spring of 1906. So far as known, it has not yet been fruited elsewhere than on the grounds of the originator. It was commercially introduced in 1906 by the Stark Brothers Nurseries and Orchards Company under the name Banner, which when printed in a certain arbitrary typographical form was registered by them as a trade-mark in the United States Patent Office, May 1, 1906.

DESCRIPTION.

Cluster large, broad conical, heavily shouldered, very compact; stem short; berries globular, of medium size, adhering tenaciously to the small green peduncles; skin moderately thick, and rather tough; amber red and glossy, but covered with a profuse bloom; flesh

[a] Letters of Joseph Bachman, August and September, 1906, and January, 1907.

translucent, juicy, and rather meaty; seeds few, very small, brown; flavor refreshing subacid to sweet and aromatic; quality good to very good. Season, late August and early September in Franklin County, Ark., ten days or two weeks later than Delaware.

The vine is reported by the originator to be very vigorous and productive.

The cluster illustrated on Plate XXIX was grown by Mr. Joseph Bachman, at Altus, Franklin County, Ark.

JOSEPHINE PERSIMMON.

(SYNONYMS: *American Honey; Honey.*)

[PLATE XXX.]

Of the varieties of this valuable native fruit that have thus far been brought to the attention of the Department of Agriculture, the best in dessert quality is the one here described. It was received first from T. V. Munson & Son, of Denison, Tex., who have catalogued[a] it since 1896 as "*American Honey*," their dissemination consisting chiefly of seedlings grown from a top-grafted tree standing upon their grounds. Attention to the apparent identity of American Honey and Josephine, a variety gratuitously disseminated by the late Judge Samuel Miller, of Bluffton, Mo., having been called by Mr. Benjamin Buckman,[b] of Farmingdale, Ill., recent investigation has revealed the following interesting facts:

About 1882 or 1883 the late Judge Miller discovered a wild persimmon tree bearing fruit of superior quality on the farm of Mr. Dennis Watson, about a mile east of Bluffton, Mo.[c] The tree was then about 3 inches in diameter, and stood close to the bank of the Missouri River, where it was in danger of being undermined by that unruly stream. Though a large tree of this species to transplant, in 1883 Judge Miller, with the help of his sons, dug it up and transported it in a small boat to his home garden at Bluffton. The transplanted tree never thrived in its new location, but the variety was preserved by grafting, and was gratuitously disseminated by him among his friends and correspondents in many parts of the country. Later he named it Josephine, in honor of a daughter of Mr. Watson, on whose farm the original tree was found. This name Mr. Miller published in 1894.[d] Meanwhile, Prof. T. V. Munson had received from Judge Miller, about 1883 or 1884,[e] three lots of native persimmon scions, designated as follows: "Flat fruited," "round fruited," and

[a] Letter of T. V. Munson, November, 1906.

[b] Benjamin Buckman in Rural New Yorker, February 20, 1904, p. 130.

[c] Letter of Samuel E. Miller, December, 1906.

[d] Colman's Rural World, February 15, 1894, p. 51.

[e] Letters of T. V. Munson, November, 1906.

"oblong fruited." These he grafted on native roots, getting one tree of each to grow. Of these, the ones labeled "flat fruited" and "round fruited" bore fruit, the one labeled "oblong fruited" proving to be staminate flowered, and therefore sterile. The flat one was found to be of better quality than the other, and after fruiting both for several years, Professor Munson, unaware that Judge Miller had meanwhile disseminated and named it Josephine, christened it "American Honey" and offered it in his catalogue for 1896, as previously mentioned.

The name Josephine having previously been applied and published by the introducer and used on scions for grafting entitles it to acceptance by pomologists, and it is so accepted by Professor Munson since the facts have become known.

The case well illustrates how easily varietal names of fruits may become confused during their preliminary testing periods. Nothing less than the utmost exactness and care by disseminators and propagators will suffice to prevent confusion and duplication of names in such cases.

DESCRIPTION.

Form oblate to roundish oblate, or quadrangular; size medium to large; surface smooth, except shallow radiating grooves near the calyx and the four sutures; color pale, translucent, yellowish, covered with a profuse whitish bloom; cavity large, broad, of medium depth, furrowed; stem short, moderately stout; calyx four parted, of medium size, pale green; apex a slender point in a slight depression; skin thin, tender; flesh yellowish, translucent, with yellow veins; seeds rather numerous, rather large, short, broad, plump, brown; flavor sweet, rich, and aromatic; quality very good. Season, early, following Early Golden.

The tree is reported to bear regular crops, and the earliness and fine quality of the fruit render the variety worthy of test by all persimmon growers.

The specimens illustrated on Plate XXX were grown by T. V. Munson & Son, at Denison, Tex., in 1906.

CHAPPELOW AVOCADO.

[PLATE XXXI.]

Interest in the avocado as a salad fruit continues to increase. The market demand is so strong in eastern cities during late autumn and winter that south Florida growers are enlarging their plantings of the later ripening sorts of the West Indian type, such as the Trapp,[a] in the expectation that their culture will prove highly profitable. In southern California quite a different condition prevails, the smaller and more hardy Mexican type being apparently better adapted to

[a] Described and illustrated in Yearbook for 1905, p. 508, Plate LXVI.

conditions in the localities where avocado culture has thus far been attempted. While no commercial plantings as large as those in south Florida have yet been made in California, certain individual trees in particular localities have proved productive and profitable, and, as the local demand at all times of the year is thus far in excess of the supply, regularity of bearing and acceptable quality of fruit in that State outweigh all other varietal characteristics.

So far as known the only variety thus far perpetuated by bud propagation in California is the Chappelow. The original tree of this variety was grown by Mr. William Chappelow, Monrovia, Cal., from seeds sent him by the Division of Pomology of the Department of Agriculture in July, 1893. The seeds had been received shortly before that time from Mr. F. Foex, then of Eddy, N. Mex., who had obtained them from fruits found by him on trees near Monterey, Mexico, where they had been subjected to a temperature of about 22° F. during several consecutive nights when in blossom during the preceding winter. As the other avocado trees of the vicinity had been killed or badly damaged by the low temperature, while these had survived and matured half a crop of fruit, it was presumed that these were especially resistant to cold, as has since been proved true in the case of seedlings descended from them.

Mr. Chappelow grew but a single tree from the four seeds sent him. This was grown in a pot at first, being transplanted to the open ground when about a foot high. The first winter, when about 4 feet high, it was cut down to the ground by a temperature of about 24° F., but soon recovered and developed into a fine, vigorous tree. It began bearing in 1898, and has rarely failed to produce at least a partial crop since that time. Scions from this tree were sent Prof. P. H. Rolfs, of the Subtropical Laboratory, at Miami, Fla., in 1902, and fruits grown on a tree top-worked therefrom were illustrated by him in 1904.[a] The variety was named Chappelow by Professor Rolfs[b] and has since been sparingly disseminated under that name. Mr. Chappelow has not kept a continuous record of the product of the tree, but states that in 1905 it bore more than 1,200 fruits. The net return to him from this tree in recent years, in addition to fruits retained for home use, has been as follows:[c] 1903, $32; 1904, $54; 1905, $130; 1906, $65. The tree blossoms at Monrovia in November and December, and ripens its crop from July 15 until September, sometimes continuing into early October.

DESCRIPTION.

Form oblong, slender, pyriform or "bottle necked;" size medium to large for the Mexican type; cavity small, shallow, and wrinkled;

[a] B. P. I. Bulletin 61. The Avocado in Florida. July 7, 1904, fig. 9 B, p 26.
[b] B. P. I. Bulletin 97. S. P. I. Inventory No. 12934.
[c] Letters from William Chappelow, August and October, 1906.

JOSEPHINE PERSIMMON.

D. G. Passmore

CHAPPELOW AVOCADO.

stem stout; surface undulating, smooth, glossy; color dull purple, with reddish-brown dots; apex a mere dot; skin very thin, tender, adhering closely; flesh pale greenish-yellow, buttery; seed large in proportion to size of fruit, roundish conical, filling internal cavity; flavor pleasant, though less rich than the best varieties of the West Indian type. Season, July to October at Monrovia, Cal.

The tree is a vigorous, rather diffuse grower, with slender wood. It is productive, although being an early bloomer it is sometimes caught by frost. It is considered worthy of testing in the thermal belts of southern California, and for domestic use along the northern edge of the avocado districts of Florida, where its superior hardiness is likely to outweigh the disadvantages of relatively small size and early time of ripening.

The specimen illustrated on Plate XXXI was grown on the original tree on the grounds of Mr. William Chappelow, Monrovia, Cal.

PECANS.

[PLATE XXXII.]

The pecan continues to engage the attention of nut growers in the South Atlantic and Gulf States almost to the exclusion of other nut-bearing trees. The increasing popularity of the nut, doubtless due in part to the development of systematic methods of grading and cracking by machinery operated by steam or electric power, which render possible the marketing of the meats ready for use, have combined to produce a market demand considerably in excess of the present supply. Under this stimulus and the production of considerable numbers of budded and grafted trees of choice varieties in southern nurseries the planting of pecan orchards is proceeding rapidly in many portions of the South. Much of this planting up to the present time has of necessity been done rather blindly as regards the adaptability of varieties to soil and climatic conditions, very few varieties having yet been fruited sufficiently outside of the localities of their origin to determine their probable behavior elsewhere. As the earlier plantings of budded and grafted trees come into bearing, it is unfortunately becoming apparent that in the infancy of the industry the stock of several of the leading varieties was considerably mixed with other sorts. In some cases closely related seedlings inferior to the sort whose name they bore appear to have been propagated from. This confusion of identity is now giving rise to diverse reports as to the behavior of particular varieties in different sections, and will doubtless require some years of careful work by nurserymen and orchardists to rectify.

Seedling orchards grown from nuts of the large varieties, such as Centennial, Frotscher, Stuart, Van Deman, Russell, etc., that came into public notice from 1875 to 1895, are now coming into bearing

throughout the South, and as both the trees and nuts commonly bear a general resemblance to their parents, they are in many instances being discussed and even labeled with the names of the parent varieties. As such seedlings are likely to disclose characteristics even more diverse from their parents if budded or grafted from and planted elsewhere, they should never be designated otherwise than as seedlings until found worthy of distinctive varietal names.

The utmost care in selection of authentic stock of these earlier varieties to bud and graft from is necessary at the present time to insure trueness to name in the nurseries and orchards. It is not safe to use grafting or budding wood of any of these sorts from trees that have not borne, except where such stock can be unquestionably traced to bearing trees that are true to name.

Less confusion exists among the more recent introductions, although some of these have in various ways been more or less confused with one another. A few of the more promising of the newer ones are described and illustrated.

ALLEY PECAN.

The original tree of this variety was grown by Mrs. C. H. Alley,[a] of Scranton, Miss., from a pecan of unknown variety presented to her by the late Col. R. Seal, of Mississippi City, Miss., in 1871. This nut she planted in a box the same fall, transplanting the young seedling that resulted therefrom to its present location in her garden in 1872. The tree began bearing at the age of about nine years and has the reputation of being a steady and prolific bearer. The variety was first propagated by Mr. F. H. Lewis, of Scranton, who set buds and grafts of it in 1896, and since that time it has been considerably disseminated by him and others under the name Alley. The original tree bore about 200 pounds of nuts in 1905, and had a fair crop when the storm of September, 1906, occurred. This destroyed a considerable portion of the crop and broke several large branches from the tree, though not enough to permanently injure it.

DESCRIPTION.

Size medium, averaging 60 to 80 nuts per pound; form, oblong to ovate conical, with moderately sharp quadrangular apex; color, bright yellowish brown, with rather long and conspicuous black markings; shell brittle, thin; partitions very thin; cracking quality excellent; kernel plump and well filled out, though deeply grooved and considerably undulated and irregularly indented; kernel bright, brownish straw color; texture firm and fine grained; flavor sweet, delicate, and free from astringence; quality very good.

The specimens illustrated on Plate XXXII were grown on the original tree in the garden of Mrs. C. H. Alley, at Scranton, Miss.

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[a] Letter from Mrs. C. H. Alley, November, 1906.

The tree is a moderately strong, though rather slender, grower and is reported to be productive in several localities where it has been top-worked during the past five or six years.

TECHE[a] PECAN.

(SYNONYMS: "*Frotscher No. 2;*" "*Duplicate Frotscher;*" "*Fake Frotscher;*" "*Spurious Frotscher.*")

Among the budded trees of the Frotscher pecan when first disseminated by Mr. William Nelson and the late Mr. Richard Frotscher, of New Orleans, about 1885,[b] it has recently been discovered that there were trees of at least one other variety quite closely resembling it in wood and habit of growth, but yielding a smaller and more conical nut. This sort, which reached a number of growers, including Mr. J. B. Wight,[c] of Cairo, Ga., and Dr. J. B. Curtis, of Orange Heights, Fla., in this way, has proved to be of sufficient merit to entitle it to a distinctive name. The place of its origin is not known, but since it appears to trace to the first lot of Frotscher scions received by Mr. Nelson [d] from Mr. Frotscher for propagation, all of which were supposed to have come from the original Frotscher tree near Olivier, La., on the Bayou Teche, it is probable that the parent tree of this one was somewhere in that vicinity. Acting on this supposition, the committee on nomenclature and standards of the National Nut Growers' Association, at its annual meeting at Scranton, Miss., in November, 1906, named the variety "Teche" to distinguish it from the true Frotscher. As there appears to be good reason to suppose that several other varieties closely resembling Frotscher have been and still are mixed with that variety in many orchards and nurseries, the name Teche should not be indiscriminately applied to all the "spurious" Frotschers, but should be restricted in its application to the one which is here described from specimens grown by Mr. Wight on trees obtained from the Nelson nursery in 1895.

DESCRIPTION.

Size medium to large, averaging 55 to 65 nuts per pound; form long oval, compressed, tapering gradually, with the smaller specimens slightly curved near apex; color bright, light, and free from the objectionable brownish veining of the Frotscher, with few broken black stripes; shell comparatively thin, but thicker than Frotscher, with which it was disseminated through error; partitions thin and soft; cracking quality excellent; kernel bright, plump and uniformly well

[a] Pronounced Tĕsh.

[b] Yearbook, 1904, p. 408.

[c] Letters from J. B. Wight, November, 1906; also The Nut Grower, June, 1906, p. 199.

[d] Wm. Nelson in The Nut Grower, August, 1906, p. 18.

filled, with shallow grooves; texture of meat firm, fine grained, solid, creamy in color; flavor delicate, rich; quality very good.

The specimens illustrated on Plate XXXII were grown by Mr. J. B. Wight, Cairo, Ga.

The tree is of more slender and upright habit of growth than Frotscher, and is reported to be fully as productive as that variety in Georgia and Florida. It is worthy of trial wherever that variety succeeds.

Curtis Pecan.

(Synonym: *Curtis No. 2.*)

The original tree of this variety was grown by Dr. J. B. Curtis, of Orange Heights, Fla., from a nut of the "Turkey Egg" pecan obtained from Arthur Brown, of Bagdad, Fla., in 1886. It bore about a dozen nuts in 1893, and has borne a crop each year since then, except in 1902, when heavy rains at blooming time prevented fertilization of the blossoms. It was first propagated by Doctor Curtis in 1896, and was disseminated by him somewhat later. The original tree, though heavily cut for scions, yielded 80 pounds of nuts in 1905.[a] The variety appears to have been first described and illustrated by Hume[b] in 1900.

DESCRIPTION.

Size medium, 60 to 70 nuts per pound; form ovate conical, compressed, with a sharp pointed base and an inclination to curve near apex; color bright, with very few black stripes, but sparsely stippled with black over most of the surface; shell very thin and brittle; partitions thin; cracking quality good; kernel very plump and thick, free from indentation other than the narrow grooves, which are of medium depth; color bright, except certain brownish stippling that perceptibly darkens the tint in some specimens; texture firm, crisp; flavor sweet and rich; quality very good.

The specimens illustrated on Plate XXXII were grown by Dr. J. B. Curtis, at Orange Heights, Fla.

The tree is reported to be slender and rather pendulous in habit of growth and regularly productive. The variety is of special promise for Florida growers, as it is one of the few sorts that have originated and been thoroughly tested in that State. It is reported to be rather hard to propagate, the wood being slender and the buds not numerous. Doctor Curtis reports it free from attack by the bud worm where such sorts as Rome and Centennial are badly damaged by it.

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[a] Dr. J. B. Curtis in the Nut Grower, June, 1906, pp. 200–201, and letter of February 11, 1907.

[b] Florida Agricultural Experiment Station Bulletin 54, August, 1900, pp. 203–209.

E. I. Schutt

A. HOEN & CO. BALTIMORE

PECAN VARIETIES.

Georgia Pecan.

(Synonym: *Georgia Giant.*)

The original tree of this variety is one of a large number of seedlings grown in nursery row by Mr. G. M. Bacon,[a] of Dewitt, Ga., from nuts of unknown parentage in 1885. Enough of these seedlings for a 30-acre orchard when planted 30 feet apart were transplanted to their present locations the following year. In 1891 this tree, which was the first in the orchard to bear, yielded 32 nuts, which are said to have weighed 1 pound. The following year its crop was $2\frac{1}{2}$ pounds, increasing annually until 1902, when it yielded $4\frac{1}{2}$ bushels of nuts. Its bud propagation, begun in that year, has resulted in such heavy cutting of the young wood that the crops since then have been comparatively light.

DESCRIPTION.

Size large to very large, averaging 40 to 50 nuts per pound; form round ovate, with a tendency toward inequality of sides; color rather dull and dark grayish brown, sparsely striped with black; shell rather thick, with moderately thick and soft partitions, yet cracking well; kernel broad, plump, rather bright and very attractive; texture rather soft and inclined to be coarse, though of pleasant flavor and excellent quality.

The specimens illustrated on Plate XXXII were grown by the G. M. Bacon Pecan Company, at Dewitt, Ga.

The tree is a sturdy, strong grower, precocious and productive, and worthy of thorough test throughout Georgia and adjacent States.

Delmas Pecan.

The original Delmas pecan tree was grown from a nut planted by Mr. A. G. Delmas at his place at Scranton, Miss., about 1877. It began bearing in 1884, and has been known under the name Delmas since the following year. It was propagated in a limited way by Mr. Delmas about 1890 by grafting both in nursery and orchard. Its general dissemination, however, appears to have occurred in connection with the "Schley" about 1902, mixed scions of the two varieties received from Mr. Delmas having been grafted in the Pierson nursery, at Monticello, Fla., and disseminated under the name Schley before the admixture was discovered. The wood of the Delmas is so much stouter and more erect than that of the Schley variety that little difficulty is experienced in separating them even in the nursery row.

The original Delmas tree was blown down by the September storm of 1906 before the crop was ripe, but was severely headed back soon thereafter and righted, so that it is hoped it will survive.

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[a] Letter from H. C. White, Dewitt, Ga., January, 1907.

DESCRIPTION.

Size large to very large, averaging 40 to 50 nuts per pound; form oblong ovate, rather pointed at base and rather bluntly quadrangular at apex; and distinctly marked by four conspicuous ridges extending from the apex nearly to the base of the nut; color grayish brownish, sparingly marked with black; shell rather thick, with partitions soft but corky; cracking quality good; kernel plump and well filled, grooves rather narrow, but shallow, and surface undulating; kernel bright straw color, very attractive; texture rather soft and open; flavor sweet, pleasant; quality good.

The specimens illustrated on Plate XXXII were grown by Mr. A. G. Delmas, Scranton, Miss.

The tree is a strong grower, of erect and roundish head, very distinct from the Schley, with which it has been somewhat mixed in nurseries and orchards. It is productive and promising for the lower pecan districts, such as the Gulf coast region, where it originated.

FREIGHT COSTS AND MARKET VALUES.

By Frank Andrews,
Scientific Assistant in Transportation, Division of Foreign Markets, Bureau of Statistics.

FREIGHT COSTS AND MARKET VALUES OF COTTON AND WHEAT.

It is well known that goods whose value is high in proportion to their weight are likely to be charged higher freight rates than goods of relatively low value. It is understood, however, that value is not the only condition affecting freight charges; under some circumstances a higher rate may be charged for a less valuable than for a more valuable commodity between the same points. The influence of value and weight upon the cost of carrying is illustrated in the case of two of the most important farm products of the United States—cotton and wheat. And it is of no little interest to note that this rule of freight traffic applies to the cost incurred by farmers in hauling their products from farms to shipping points.

An investigation was made by the writer, under the authority of the Bureau of Statistics of the Department of Agriculture, in September, 1906, to learn certain facts about hauling farm products on country roads, and from results of this inquiry it is estimated that it costs an average of 16 cents per 100 pounds to haul cotton from farms to shipping points, while the cost for wheat is 9 cents. The average distance of cotton farms from local shipping points is 11.8 miles, the average weight of a wagonload of cotton is 1,702 pounds, and the average cost of hauling the load, $2.76; the corresponding averages for wheat are 9.4 miles, 3,323 pounds, and $2.86. It is plain that cotton may be profitably hauled for greater distances and in smaller loads than wheat, since the value of an average load of the cotton picked in 1905 was more than $170, while a load of wheat was worth about $40.

CHARGING WHAT THE TRAFFIC WILL BEAR.

The average railway freight rate for cotton from local shipping points to seaports is estimated at 40 cents per 100 pounds, while the corresponding rate for wheat is about 20 cents. This difference in railway charges between these two commodities illustrates the tendency of value to influence transportation costs, and also shows one of the several phases of the principle of railway rate making which is often described as "charging what the traffic will bear."

RELATIVE VALUES AND OCEAN RATES.

On the ocean, also, freight charges for cotton are higher than those for wheat. The rates quoted for regular lines of steamers for carrying cotton from Galveston, New Orleans, and New York to Liverpool averaged during the year ending June 30, 1906, about 32 cents per 100 pounds, while the corresponding rate for wheat was only one-fourth that sum, or 8 cents per 100 pounds. A cargo of cotton shipped from Galveston to Liverpool frequently contains as much as 5,500,000 pounds, and the value in 1905–6 of such a cargo at Galveston was not far from $600,000, while the same quantity of wheat would have been worth from $70,000 to $90,000. The entire cost of carrying this amount of cotton from the farms in the United States to Liverpool, not including costs of transfer and terminal charges, at the average rates estimated in this article, would be about $50,000, while the corresponding cost for wheat would be $24,000.

COTTON.

COST OF HAULING FROM FARMS.

The cost of hauling cotton and certain other products from farms to shipping points has been determined with the aid of the county correspondents of the Bureau of Statistics of the Department of Agriculture. In answer to questions sent out by the Department in August, 1906, correspondents in 555 cotton-producing counties returned, in addition to other data, information as to the number of pounds of cotton usually hauled at one load, the time required for the longest haul by any considerable number of farmers, and the usual cost per day for hiring teams.

The cost of hauling a wagonload of cotton from the farm as determined here is the cost of hiring such work done, though it is usual for a farmer to do his own hauling and not to hire such work done. The actual cost to an individual farmer at a given time may vary greatly from the usual cost of hiring a team, wagon, and driver; he may haul his cotton when he has nothing else to do and when his team would be otherwise idle, or he may be compelled to haul at a time and under conditions that may involve no little sacrifice of labor and expense. However, in determining an average value of the service of hauling it may be assumed that in a given community the usual cost per day for hiring a team, wagon, and driver is a fair measure in that community of the average outlay of capital and labor required to perform the service in question.

TWO REGIONS COMPARED.

By this method the cost of hauling cotton from farms in the South Atlantic States was found to be 13 cents per 100 pounds, while the

average for all the cotton regions west of Georgia and the Allegheny Mountains was 17 cents. The difference in cost between the two regions was due chiefly to the difference in the average distances from farms to shipping points, the distance for the South Atlantic States being 9.6 miles and for the South Central States and Territories 12.7 miles.

FREIGHT RATES TO SEAPORTS.

Nearly three-fourths of the cotton arriving at Galveston is carried by railroads at a uniform rate, and comes from stations serving a large part of the area of the State of Texas. The railroad freight rate from Texas "common points" to Galveston was 55 cents per 100 pounds during the year ending June 30, 1906. Of the 188 Texas counties which produced cotton in 1905, 118 were in the region to which the "common points" rate of 55 cents applied. The usual rate for stations in 14 counties was 65 cents, for 7 counties 58 cents, 5 counties 49 cents, 4 counties 66 cents, 4 other counties 54 cents, 2 others 63 cents, while the rates to Galveston from stations in 34 counties, which were situated between the region of the "common points" and Galveston, ranged from 6 to 48 cents per 100 pounds. The average rate from all points in Texas, taking into account the quantity of cotton affected by each rate quoted, was 52.9 cents per 100 pounds. The average cost of shipping cotton from Indian Territory to Galveston during the year just mentioned is estimated roughly at 66 cents per 100 pounds, and the average rate from Oklahoma to Galveston is estimated at 72 cents per 100 pounds.

GALVESTON, NEW ORLEANS, AND SAVANNAH.

Taking into account the relative quantity of cotton produced in the region affected by each rate, the average charge to Galveston from local stations in Texas, Indian Territory, and Oklahoma during the year mentioned was 54 cents per 100 pounds.

Average rates from points of original shipment to New Orleans, Savannah, and New York were estimated by adding the rates given for a large number of representative local shipping points and dividing the sum by the number of items. In this manner the mean rate to New Orleans from 347 stations in Mississippi, Louisiana, and Tennessee was $1.14 per bale, or about 23 cents per 100 pounds. Cotton sent to Savannah from 738 stations in Georgia, South Carolina, Florida, and eastern Alabama was charged a mean rate of 41 cents per 100 pounds.

ROUTES AND CHARGES TO NEW YORK CITY.

Consignments of cotton to New York City from local stations in the cotton regions may be carried all the way in freight cars or may be sent down to some southern port and there transferred to one of

the lines of coasting vessels for shipment northward. The charges on cotton to New York are from 20 to 25 cents higher than the rates from the same stations to New Orleans and Savannah. The mean rate per 100 pounds to New York from 298 local points in Mississippi, by railroad routes exclusively, was 48 cents, or 25 cents more than the rate to New Orleans as given above, and the mean rate to New York from 402 stations in North and South Carolina, Georgia, and eastern Alabama was 65 cents by all-rail routes and 59 cents by rail-and-water routes. These charges, it will be seen, are from 18 to 24 cents above the rates from practically the same regions to Savannah. The mean freight charge to New York from 700 local points among the cotton fields in Mississippi, North Carolina, South Carolina, Georgia, and eastern Alabama is taken as 54 cents per 100 pounds, the same as the estimated average rate from stations in Texas, Oklahoma, and Indian Territory down to Galveston.

PRICES AT FOUR PORTS.

If the relative quantity of cotton exported from each port be taken into account, the average of the freight rates on cotton to Galveston, New Orleans, Savannah, and New York from local shipping points would be 40 cents per 100 pounds. At the four cities named the mean of the daily closing prices for Upland middling cotton for the year ending June 30, 1906, was 11 cents per pound, which was about the same as the average export value of all cotton for all United States ports during this year. The mean annual price at New Orleans and also at Galveston was 11 cents, at Savannah 10.8, and at New York 11.3 cents per pound. Thus it appears that in 1905–6 the value of cotton at the seaboard was twenty times the cost of transporting that product there from the farms, the freight charges plus the cost of hauling in wagons being 56 cents per 100 pounds.

TWO CLASSES OF OCEAN FREIGHT TRAFFIC.

Ocean freight charges are subject to more frequent changes than are railroad rates. On the ocean competition is practically free, for any man with a ship may compete for business. If the vessels at a certain port have a large amount of available space for cargo and the quantity of goods to be shipped is relatively small, freight rates are apt to be low. Such a condition may easily occur when passenger liners are in port, for their dates of sailing are fixed by a schedule previously arranged, and they must start on time whether their cargoes be large or small. Quotations of freight rates on goods carried by steamship lines are published regularly in the leading ports on the Atlantic and Gulf coasts of the United States. The mean of the quotations for cotton to Liverpool for the first week of each month during the year 1905–6 was 33 cents per 100 pounds from

New Orleans and 17 cents from New York. The rates from Galveston and other leading Gulf ports are regarded as practically the same as those from New Orleans.

Besides the regular lines of vessels, there are a large number of ships engaged in freight traffic which have no regular routes, but make contracts frequently for a single voyage at a time. On account of their wanderings throughout the commercial world these vessels are sometimes called "tramps."

ONE YEAR'S RECORD OF A "TRAMP" STEAMER.

An account of the first year's work of one of these "tramps" appeared in a daily paper in September, 1906. The vessel in question was built in England and on its first voyage carried a cargo of coal from Cardiff, Wales, to Algiers. The next trip was in search of business and the ship went in ballast from Algiers to Port Arthur, Tex., whence a cargo of cotton and cotton seed was taken to Bremen, Germany. Again a voyage in search of freight was made, and at Cardiff a second load of coal was taken aboard; this time the destination was Teneriffe, in the Canary Islands. Then a second voyage was made across the Atlantic without cargo, and this time also business was found at Port Arthur, Tex., where corn was loaded for Sharpness, England. Another voyage in ballast brought the ship to Bremen and the load of kainit received there was taken to Savannah. Leaving Savannah and sailing up the coast, again in ballast, the vessel ended its first year of service as it entered the harbor of Baltimore. Here it was to receive a full cargo of grain for the Baltic Sea. Some ships are not so successful as this one in finding cargoes and occasionally lie idle for months at a time waiting for employment.

AVERAGE OCEAN RATE ON COTTON.

The average ocean rate on cotton from the United States to Liverpool for the year 1905–6 was about 32 cents per 100 pounds, excluding terminal charges, the same as the annual mean of the quoted rates from Savannah to the United Kingdom. It will be noted also that the average railway rate from all local points to all ports, as estimated above, was 40 cents, while the charge from local points to Savannah was 41 cents per 100 pounds. In regard to both land and water rates Savannah occupies a medium position.

VALUES IN ENGLAND.

The sum of the cost per 100 pounds for transporting cotton on country roads, on United States railroads, and across the Atlantic, as estimated above, is 88 cents, and, with an allowance of 2 cents for transfer to ship at some United States ports, the entire cost of carrying may be taken as 90 cents per 100 pounds.

The mean price of cotton in England for the twelve months ending June 30, 1906, was about 12 cents per pound; the annual mean of the cash prices for Upland middling cotton at this market at the close of each business day for the year mentioned was 12.1 cents.

The difference in price between the four leading cotton ports of the United States and Liverpool was 1.1 cents per pound, while the cost of carrying the cotton across the ocean was about one-third of 1 cent per pound, leaving two-thirds of 1 cent for profits and other items, such as insurance, selling commissions, and cartage. The total cost of transportation from United States farms to Liverpool, including cost of transfer to ships at United States ports, was about 7.5 per cent of the value of the cotton in that city.

SUMMARY OF FREIGHT CHARGES ON COTTON.

The total cost of hauling the cotton crop of 1905 from farms to shipping points, at the rate of 16 cents per 100 pounds, as established by the investigation mentioned near the beginning of this article, would be $8,000,000; and the cost of carrying that portion of the cotton crop which was exported to Europe from farms in the United States, at the rate of 90 cents per 100 pounds, would amount to $33,000,000, of which the cost of hauling from farms would be $6,000,000, freight charges to seaboard cities $15,000,000, and ocean transportation, including transfer to ship, $12,000,000.

A summary of the transportation costs for cotton mentioned in the preceding paragraphs is given below:

Estimated average costs of carrying cotton in the United States and to the United Kingdom during the year ending June 30, 1906.

From—	Cents per 100 pounds.
Farms in 555 cotton-producing counties, by wagon, to local shipping points	16
200 local points in Texas, Indian Territory, and Oklahoma, by all-rail routes, to Galveston	54
347 local points in Mississippi, Louisiana, and Tennessee, by all-rail routes, to New Orleans	23
738 local points in Georgia, South Carolina, Florida, and eastern Alabama, by all-rail routes, to Savannah	41
298 local points in Mississippi, by all-rail routes, to New York	48
402 local points in North Carolina, South Carolina, Georgia, and eastern Alabama—	
By all-rail routes to New York	65
By rail-and-water routes to New York	59
Local shipping points to seaports, average for United States	40
Gulf ports and New York, by regular steamship lines, to Liverpool	32
Savannah, by chartered vessels, to the United Kingdom	32
United States to United Kingdom, average for all ports	32

WHEAT.

FROM FARMS TO LOCAL SHIPPING POINTS.

The average cost of 9 cents per hundredweight for hauling wheat from farms to shipping points, as mentioned at the beginning of this article, was obtained by the use of returns from 1,051 wheat-producing counties. The cost for the North Central States is 8 cents per 100 pounds, but in Kansas, Ohio, Indiana, and Michigan the rate is 6 cents, and farmers in Illinois, Wisconsin, Minnesota, Iowa, and Nebraska do this hauling at an average cost of 7 cents per 100 pounds. In Missouri the mean cost is 9 cents per 100 pounds, in North Dakota 10 cents, and in South Dakota 11 cents per 100 pounds. In the wheat region west of the Rocky Mountains the average cost is 10 cents per 100 pounds, the relatively high rate being largely due to the long distances over which the grain is moved.

The average farm value of wheat, as given by the Department of Agriculture, is the price at the local shipping points, for practically all wheat is sold by farmers at a price which includes delivery at some local market or shipping point. The average farm value of wheat in the United States on December 1, 1905, was 74.8 cents per bushel, and the average cost to the farmers of delivering this wheat at 9 cents per 100 pounds is 5.4 cents per bushel. Hence the actual value on the farm would be 69.4 cents per bushel. As the wheat crop of 1905, excluding seed, was about 622,000,000 bushels, the cost of hauling the crop from farms to places of local delivery may be given as $34,000,000, while the total value of the crop delivered at these markets and shipping points was $465,000,000.

RAILWAY CHARGES TO INTERIOR MARKETS.

From the wheat regions east of the Rocky Mountains large quantities of the grain are gathered into such interior cities as Minneapolis, Chicago, and Kansas City. The mean of the railway freight rates on wheat from 562 local stations in Illinois and Nebraska to Chicago in 1905–6 was 16 cents per 100 pounds, the same as the mean rate to Minneapolis from 311 local stations in Minnesota, North Dakota, South Dakota, and Nebraska. In estimating the mean charge to Chicago from all local shipping points, rates from Illinois and Nebraska were taken as typical of low and high rates, respectively. To Kansas City, from 456 stations in Kansas, Missouri, and Oklahoma, the mean rate is found to be about 14 cents per 100 pounds. Making allowances for the relative quantities of wheat received at each of these three primary markets during the year 1905–6, the average rate on wheat from local shipping points to primary markets in 1905–6 was 15.5 cents per 100 pounds, which, added to the average cost of hauling wheat from farms in the North Central States, makes a total cost

of transportation of 24.5 cents per 100 pounds, or 14.7 cents per bushel from farm to primary market.

GRADES AND VALUES OF WHEAT.

No attempt is made here to obtain an average market value for all wheat received at one or more leading markets. In the case of cotton, it was found that the price for the Upland middling grade at the leading United States ports and at Liverpool was approximately the average for the entire crop. But important grades of wheat are too numerous for such a method of obtaining an average value. At one city the principal grade may be "No. 2 red winter," while "No. 1 northern" may predominate in another market. Then the various practices and standards of grading wheat at the different trade centers give rise to still more classes for which price quotations are made.

MINNEAPOLIS AND CHICAGO.

The mean annual price of No. 1 northern wheat at Minneapolis for 1905–6 was 86.3 cents, and the mean freight rate from 311 stations in Minnesota, North Dakota, South Dakota, and Nebraska was 9.6 cents per bushel. The average price of wheat at local shipping points in these four States on December 1, 1905, was 68.6 cents per bushel, so that the cost of this wheat at Minneapolis would be 78.2 cents, plus such items as elevator charges, fees for inspection and weighing, and dealers' profits, making a total cost of probably not more than 80 cents per bushel, or about 6 cents less than the value of No. 1 northern.

At Chicago the mean price of No. 2 red winter wheat for the year named was 86.9 cents, and the average farm price in Nebraska and Illinois for all wheat on December 1, 1905, was 71.8 cents, including cost of hauling from farms, while the mean freight rate to Chicago from local stations in those two States was 9.6 cents per bushel. According to these figures all the marketable grades of Nebraska and Illinois wheat were worth, in the Chicago market, probably about 83 cents per bushel, or 3.9 cents less than No. 2 red winter.

RATES AND PRICES AT KANSAS CITY.

In Kansas, Nebraska, Missouri, and Oklahoma the average value of wheat at local points December 1, 1905, was 70.8 cents, and the mean freight charge from these stations to Kansas City was 8.4 cents per bushel. The cost, then, at Kansas City, would be 79.2 cents, plus minor charges. The mean annual value of No. 2 hard wheat at this market for 1905–6 was 81.1 cents. In this case, the only one of the three mentioned, there is an approximate agreement in the prices used; the farm value and the price at the primary market seem to apply to grades of about the same average quality.

The average of the three prices just mentioned for Chicago, Minneapolis, and Kansas City, allowing for the relative importance of each price in proportion to the quantity of wheat received at each market, is 85.1 cents per bushel, and the average farm value, including cost of hauling, of the crop in the States and Territory named, was 70.8 cents. The average freight rate being 9.3 cents, the average value on December 1, 1905, at the three primary markets for all marketable grades of the wheat of this region, would be probably not more than 82 cents. This would make only 3.1 cents difference between the average value of all wheat and the price of three of the better grades.

RAIL AND WATER ROUTES TO SEABOARD.

From the interior wheat markets to the seaboard there are two general routes, one eastward to Atlantic ports and the other leading south to the Gulf of Mexico. Along the eastward routes the railroads have to share their traffic with the waterways formed by the Great Lakes and the connecting rivers and canals.

The Mississippi River is a potential although not always an active competitor for the traffic from the wheat regions to New Orleans. During 1904 and 1905 practically no wheat was carried by river from St. Louis to New Orleans.

RATES FROM PRIMARY MARKETS.

The freight charge from Chicago to New York or Boston for wheat intended for export was 15 cents per 100 pounds in 1905–6, by all-rail routes. During the same year boats on the Great Lakes were chartered to carry wheat from Chicago to Buffalo at rates ranging from 1.25 to 3 cents per bushel, and the railway charge from Buffalo to New York was 4.5 cents per bushel on wheat intended for export.

The lake-and-rail rate, then, from Chicago to New York ranged between 5.75 and 7.50 cents per bushel. Shipments by way of the lakes and Erie Canal were sent at still lower rates. During the calendar year 1905 the mean rate by lake and canal to New York from Chicago was 5.53 cents per bushel, by lake and rail the rate was 6.40 cents, and the railroads charged 9.90 cents for carrying the wheat the entire distance. The all-rail rate from Chicago to Baltimore and Norfolk was 3 cents per 100 pounds less than the rate to New York or Boston and 1 cent below the charge to Philadelphia, on exported wheat. The mean all-rail rate on exported wheat from Chicago to the Atlantic seaboard may be taken as about 13 cents per 100 pounds, or 7.8 cents per bushel. On wheat intended for domestic consumption the rate to Boston from Chicago was 4.5 cents per 100 pounds above the export rate, and the mean rate on domestic wheat from Chicago to Boston, New York, Philadelphia, Baltimore, and Norfolk exceeded the mean export rate by 3 cents per 100 pounds, or 1.8 cents per bushel.

DIRECT SHIPMENTS AT LOWER RATES.

The average rate on wheat from local points in the interior to the Atlantic and Gulf coasts is less than the sum of the charge from those points to primary markets plus the charge from these markets to the seaboard. It may be assumed that the cost of shipment to the coast from Kansas City, Omaha, and Minneapolis is not less than the average from local points in the wheat region surrounding those cities and is probably greater than the rates from many important shipping points lying near the seaports. The mean rate from local stations in the wheat region east of the Rocky Mountains to the Atlantic seaboard is taken as 13.4 cents per bushel, which is the mean rate from Kansas City and Omaha to that coast, and the rate to the Gulf as 10.8 cents, the same as from Kansas City to New Orleans and Galveston. The average rate from local shipping points to both coasts, allowing for the relative quantity of wheat exported from each, would be 12.6 cents per bushel.

SHIPS CHEAPER CARRIERS THAN WAGONS.

Ocean rates were higher than usual during the year 1905–6, and the mean charge for carrying wheat by regular steamship lines to Liverpool from New York, a distance of about 3,100 miles, was 3.8 cents per bushel, or 1.6 cents less than it cost a farmer to haul the wheat 9.4 miles from his farm to a neighboring railroad station. Sometimes the rate on wheat from an Atlantic port in the United States to Liverpool is as low as 1.5 cents per bushel, or 3.9 cents less than the average cost of hauling from the farms. The cost of shipment in chartered vessels from Baltimore to ports in the United Kingdom for the year 1905–6 was about 7.8 cents per bushel on an average, a cost much higher than the rate charged by vessels of regular lines, and 2.4 cents more than the cost of wagon transportation. The mean rate by regular lines from New Orleans was about 6.8 cents per bushel and may be taken to represent the Gulf coast as the New York rate is in general typical of the rates from Atlantic ports.

The large number of grain ships chartered at Baltimore during 1905–6 makes it fairly safe to take the cost of charters at that port as an approximate average for the whole coast and not far removed from charter rates from the Gulf to England. The average of the rates on wheat to Liverpool by regular lines from New Orleans and New York and by chartered vessels from Baltimore, not including costs of transfer, may be taken as 4.8 cents per bushel, or 0.6 cent less than the cost of hauling in wagons from farms to shipping points.

PRICES AT LIVERPOOL.

The mean price at Liverpool for "No. 2 red winter" wheat for five months ending June 30, 1906, the season when this grade was most frequently quoted there, was 92.6 cents per bushel, and the cost of

transportation to Liverpool from local points in the Middle West is estimated at 17.4 cents per bushel. Deducting this freight charge from the price just quoted, and allowing 1.5 cents for profits and minor costs, the value of this quality of wheat at local shipping points in Illinois, Minnesota, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma would be 73.7 cents, or only 2.9 cents per bushel above the average value of all wheat at those points.

THE PACIFIC COAST.

The Pacific coast wheat trade has some features distinct from the trade east of the Rocky Mountains. The wheat exported from the Pacific coast to Europe is carried almost entirely in sailing vessels. The rates quoted for chartering sailing ships for these long voyages showed but little variation during the year, the average charge to the United Kingdom from San Francisco, Portland, Tacoma, and Seattle being 16.8 cents per bushel for wheat, not including costs of transfer. Owing to the small exports of wheat from San Francisco in 1905–6, the rates from that port have practically no effect upon the average just mentioned.

The mean of freight charges to Tacoma, Seattle, and Portland from 459 local stations was 10.2 cents per bushel, which, added to the ocean rate, made the total transportation cost from these local points to Liverpool 27 cents per bushel. The mean Liverpool price for the year ending June 30, 1906, being 96 cents for white Walla Walla wheat, the value at shipping points near the farms in the Pacific Northwest would be 69 cents, less minor costs of marketing the grain. These minor costs of marketing may be estimated as between 1 and 2 cents per bushel, thus making the value of this grade of wheat in local markets near the farms 67 or 68 cents per bushel, being but a slight variation from the actual average of all wheat at these shipping points, which on December 1, 1905, was 66.2 cents. The average local value for the year 1905–6 was a few cents less than the price on December 1.

APPARENT DISCREPANCIES EXPLAINED.

However, if the mean railway rate to the coast from local points in Oregon, Washington, and Idaho be subtracted from the mean price of Bluestem wheat at Portland, Oreg., for the year ending June 30, 1906, which was 74.5 cents, the value of this variety at those local points would be 64.3 cents per bushel, from which minor costs of marketing are still to be deducted, and the net value would remain not far from 63 cents. There is an apparent discrepancy here, for the average value of all wheat on December 1, 1905, including grades inferior to Bluestem, was 66.2 cents per bushel, or about 3 cents higher than the value of Bluestem. A greater discrepancy occurs when the mean

price of "northern club" wheat at Tacoma, 71.6 cents per bushel, is reduced to a value at local shipping points by subtracting the freight charge of 10.2 cents per bushel.

These variations are due apparently to relatively high prices on the Pacific coast in November, 1905, the month in which the December farm values were actually obtained, and from this cause the farm price for wheat in Pacific coast States for December 1, 1905, is a few cents higher than the average for the entire year. About the 1st of November, 1905, Bluestem wheat at Portland, Oreg., was quoted at 78 cents, and the Tacoma price for northern club was 74.5 cents per bushel. The average value of these grades at local shipping points, estimated by deducting freight and other cost from the mean of the two prices last quoted, is from 64.1 to 65.1 cents per bushel, or only 1.1 or 2.1 cents less than the average value of all wheat at those points, as obtained for December 1.

The average cost of hauling wheat from farms in Washington, Oregon, and Idaho is 12 cents per 100 pounds, or 7.2 cents per bushel. The average farm price on December 1, 1905, for these three States being 66.2 cents, the net value on farms would be 59 cents per bushel.

EXPORTS AND FARM VALUES.

The apparent increase in the consumption of wheat in the United States in the five years ending June 30, 1906, and the accompanying decrease in exports was attended by a rise in local prices, which, if distributed proportionally in all parts of the country, would almost forbid the exportation of any wheat at all. During the year ending June 30, 1902, the exports of wheat, including flour (in terms of grain), from the United States amounted to 235,000,000 bushels and the average farm value, including cost of hauling, was 62.4 cents per bushel. For the next four years the annual exports and average farm values were, respectively, 203,000,000 bushels and 63 cents per bushel, 121,000,000 bushels and 69.5 cents, 44,000,000 bushels and 92.4 cents, and in 1905–6 the exports were 98,000,000 bushels and the farm value 74.8 cents per bushel. The value of wheat sent to Liverpool in this last-mentioned year and the freight costs along the way, expressed in averages applying to the United States as a whole, were:

Value of wheat and cost of carrying from United States farms to United Kingdom, 1905–6.

	Cents per bushel.
Value on farms in United States before hauling	69.4
Cost of hauling to local shipping points	5.4
Average farm value, including cost of hauling	74.8
Railway freight charges from local points to seaports	11.6
Ocean freight charges to United Kingdom	9.6
Minor costs of sale and shipment	1.5
Value at port in United Kingdom	97.5

MAXIMUM FARM VALUE OF EXPORT WHEAT.

The value in the United Kingdom as estimated upon a basis of a farm value in the United States of 74.8 cents per bushel (including cost of hauling) is a few cents higher than the actual prices of United States wheat at Liverpool. The average import value of all wheat brought into the United Kingdom from the United States during the year 1905–6 was 95.9 cents, and the mean price at Liverpool during that period for No. 2 red winter and Walla Walla white grades was 94.3 cents per bushel.

COST OF EXPORTING KANSAS WHEAT.

For wheat shipped from Kansas for export the values and freight rates were as follows for the year ending June 30, 1906:

Value of wheat and cost of carrying from Kansas farms to Liverpool, 1905–6.

	Cents per bushel.
Value on farms before hauling	67.4
Cost of hauling to local shipping points	3.6
Farm value, including cost of hauling	71.0
Railway freight charges to Gulf ports	10.8
Ocean freight, Gulf ports to Liverpool	6.8
Minor costs of sale and shipment	1.5
Value at Liverpool	90.1

The corresponding value of wheat shipped from Minnesota to Liverpool by way of New York would be 89.7 cents per bushel. None of these estimates of value in Liverpool include selling costs and dealers' profits in England, which of course are included in the prices quoted above for specific grades. The mean price in Liverpool for No. 2 red winter grade being 92.6 for the season 1905–6, the value just estimated for Kansas wheat allows a margin of 2.5 cents for minor charges in the United Kingdom and for differences between the average price of all Kansas wheat and the price of the No. 2 red winter grade.

SUMMARY FOR WHEAT.

For the sake of convenience the principal transportation costs and market values mentioned in the foregoing discussion of wheat are collected in this statement:

Wheat—principal values and freight charges mentioned in this article.

VALUES.

	Cents per bushel.
Average value on farms in the United States before hauling, December 1, 1905	69.4
Average farm value, including cost of hauling, December 1, 1905	74.8

	Cents per bushel.
Average price in Chicago, Minneapolis, and Kansas City, year ending June 30, 1906, for certain grades[a]	85.1
Price of Bluestem, Portland, Oreg., November 2, 1905	78
Price of northern club, Tacoma, Wash., November 1, 1905	74.5
Average farm value, including cost of hauling, Oregon, Washington, and Idaho, December 1, 1905	66.2
Mean price No. 2 red winter, Liverpool, five months ending January, 1906	92.6
Mean price Walla Walla white, Liverpool, for year 1905–6	96
Mean price of Bluestem, Liverpool, 1905–6	97

FREIGHT COSTS FOR YEAR ENDING JUNE 30, 1906.

Hauling from farm to local shipping points	5.4
Average rate from 1,329 local shipping points in Illinois, Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Oklahoma to Chicago, Minneapolis, and Kansas City	9.3
Mean rate on export wheat, Chicago to Atlantic ports	7.8
Mean rate on export wheat, Missouri River to Atlantic ports	13.4
Average rate on export wheat, Kansas City, Omaha, St. Paul, and Minneapolis to New Orleans and Galveston	11.4
Average rate from all local shipping ports in above-named States to Atlantic and Gulf ports	12.6
Average rate from 459 local shipping points in Oregon, Washington, and Idaho to Portland, Tacoma, and Seattle	10.2
Average rate from all local shipping points to all ports in the United States	11.6
Average ocean freight rate, Atlantic and Gulf ports to the United Kingdom	4.8
Average ocean freight rate, Pacific ports to the United Kingdom	16.8
Average ocean freight rate, all United States ports to the United Kingdom	9.6

OCEAN FREIGHT RATES AND BRITISH IMPORTS.

In the United Kingdom, where a large part of the wheat consumed is imported, the cost of ocean transportation is an important matter. During the calendar year 1905 the wheat, not including flour, imported into that country amounted to 182,000,000 bushels and the average cost of ocean freight was about 9 cents per bushel, thus making the total cost of carrying it on sea more than $16,000,000. The average of 9 cents per bushel was estimated from the mean annual freight rates from eight leading regions of supply to the United Kingdom. The rates quoted for all the countries except the United States and Canada were taken from the London Times and the Review of the River Plate (of Buenos Aires), while the other rates were found in commercial papers and in circulars issued by freight brokers at various ports. The mean annual rates on wheat from each of these regions to the United Kingdom for 1905 are given on the next page.

[a] No. 2 red winter at Chicago, No. 1 northern at Minneapolis, and No. 2 hard at Kansas City.

Mean annual freight rates on wheat to the United Kingdom.

From—	Cents per bushel.
Canada [a]	4
United States, Atlantic and Gulf ports [b]	5
Russia, Black Sea ports	7
Roumania	7
British India	9
Argentina	11
Australia [c]	14
United States, Pacific ports [b]	17
Average [d]	9

REMOTE SOURCES OF ENGLAND'S WHEAT SUPPLY.

The effect of applying to wheat the same rates as are charged some other articles in ocean traffic would be alarming to the British people and to all other nations which receive an important part of their wheat supply from over the sea; and the readjustment of prices brought about by such changes in transportation costs might have serious results for the agricultural interests in many countries of supply. The bread of England is made from wheat carried over vast distances and at rates lower than would have been dreamed of a few generations ago. To Liverpool from the Atlantic coast of the United States and also from the Black Sea the grain makes a journey of 3,000 miles, while twice that distance is traversed from the River Plate and from Bombay; large supplies are carried 10,000 miles from Australia; and 3,000,000 bushels in 1905 were taken by sailing vessels from Puget Sound, down the west coast of America and around Cape Horn, a voyage of 15,000 miles, or more than one-half of the distance around the globe. From these distant ports, from 3,000 to 15,000 miles away, the average charge for carrying wheat to England for the year 1905, as mentioned in a preceding paragraph, was 9 cents per bushel, or only one and two-thirds times the cost of hauling over 9 miles of country roads in the United States.

If the average cost of carrying cotton the 3,000 or 4,000 miles from United States Atlantic and Gulf coasts to the United Kingdom were applied to transportation of wheat over the routes mentioned above, ranging in length from 3,000 to 15,000 miles, the rate per bushel would be 19 cents instead of 9, and the margin between prices in England and in countries of supply would average 10 cents per bushel more than in 1905.

[a] Rate from Boston used here.
[b] For year ending June 30, 1906.
[c] Mean rate of eight quotations.
[d] Weighted in proportion to imports from each region named.

FUTURE CHANGES IN FREIGHT COSTS.

Judging from the changes during the past few generations, it is natural to expect that costs of freight on land and water may be lower in the future than at present. Improved methods of loading and unloading freight, economies in the disposition of cars and vessels so as to avoid more than at present the hauling of empty cars and the making of voyages in ballast, and an increase in the quantity of valuable freight paying high rates per unit of weight would all tend to lower the cost of transporting farm products.

In hauling products from farms in wagons there are opportunities for a saving in cost. In many regions in the United States the improvement of a road, or a short rough section of a road, would allow much larger loads to be hauled than at present. If it were possible to increase the average weight of a wagonload of cotton in the United States from 3 bales, as it now is, to 4 bales, without increasing the cost of hauling the load, the saving on a crop equal to the one picked in 1905 would amount to $2,000,000; and if the average load of wheat, now 55 bushels, were increased by 20 bushels, the saving effected in hauling a crop like that of 1905 would be more than $8,000,000.

NEW TOBACCO VARIETIES.

By A. D. Shamel,

Physiologist in Charge of Tobacco Breeding Investigations, Bureau of Plant Industry.

HOW THE NEW VARIETIES WERE BRED.

The four varieties of cigar-wrapper tobacco described in this paper have been produced by the writer in the breeding experiments of the Department of Agriculture. These experiments were first undertaken in the Connecticut Valley in the fall of 1903, at which time the writer began a study of the varieties of tobacco grown in the valley, made a large number of crosses of the native with standard foreign-grown varieties, and selected about 400 individual seed plants growing at that time in the fields. These hybrids and selections, together with others made later, about 750 in all, have been tested, under the supervision of Dr. Herbert J. Webber, Physiologist in Charge of Plant Breeding Investigations, in the field, laboratory, and manufacturing establishments during the past three seasons, the inferior and undesirable types have been discarded, and the valuable types have been used for further tests. Out of all the many selections and hybrids made in 1903 two hybrids and two selections have proved to be valuable not only in the Connecticut Valley but in other sections of the United States adapted for growing cigar-wrapper varieties of tobacco.

In the hybridization experiments considerable care and attention were given to the selection of varieties used as parents. The object of these experiments was to secure varieties of tobacco adapted to the soil, climatic, and trade conditions of the valley, producing the size, shape, and quality of leaves best suited to economical cigar-wrapper manufacture. The native Connecticut Valley varieties of tobacco produce long, large, and pointed leaves, from one of which it is possible to cut only from two to four good cigar wrappers. On the other hand, the typical leaf of the Cuban and Sumatra varieties of tobacco is short and round, from which the American cigar maker cuts from six to eight and even more wrappers. The Cuban and Sumatra varieties used as parents in these experiments were grown under shade in the Connecticut Valley to a limited extent in 1903, some of the plants of which bore leaves of the character that is most desirable for making cigar wrappers. These best plants were selected

for breeding and were crossed with the best plants of the native Connecticut Havana Seed and Broadleaf varieties. There was usually found on each plant about a dozen flowers at the right stage of development for crossing. All of the other flowers on the same seed head were cut off and thrown away. The flowers used for crossing were then emasculated, and a small, one-quarter pound, light manila-paper bag was placed over each individual flower. In about forty-eight hours the bags were removed, the pollen to be used for pollination was dusted over the receptive stigma, and the bags replaced. As the individual pods set from three to seven thousand seeds each, the possibility of raising a large progeny from every cross is apparent.

A large number of crosses were made, in one case using the Connecticut varieties as the mother parents and in the other instance using the imported varieties as the mother parents. In 1904 about one hundred plants were grown in the field from every cross-fertilized pod of seed. The results of this test made it possible to weed out a large number of the unprofitable hybrids at once and to save for planting in 1905 a comparatively few plants from a few of the best progeny rows. Two of these plants were so clearly new and distinct types that they stood out strongly from all the rest of the plants in the fields. The progeny of these plants have come true to seed in the seasons of 1905 and 1906 and are recognized as of such value that they have been named and their seed distributed to a limited extent for commercial growing. In all cases self-fertilized seed has been used every year for planting, and no such violent breaking up in type has been observed at any time as is the case with hybrid varieties of corn, cotton, and certain other crops.

The original selection of seed plants in the crops of the Connecticut Valley grown from Florida Sumatra and imported Sumatra seed were made in the season of 1903, with a view to securing improved and uniform varieties adapted for growing under shade. In these fields the plants varied in type to a remarkable degree. Some of them were of a desirable type, while many were wholly worthless for cigar-wrapper production.

In these fields the writer found individual plants of types not heretofore known in Connecticut or Florida or other districts where this variety had been grown, which possessed certain characters that were extremely important from the standpoint of cigar-wrapper production and manufacture. The seed of many individuals of all general types of plants growing in the fields under shade was saved under bags to protect the flowers from cross-pollination. The seed of these individual plants was sown in separate sections of tobacco seed beds in 1904, and test rows of about 100 plants were raised in the field, a row of plants from every seed plant. In the season of

1904 seed of the best plants in the rows producing the best tobacco was saved under bag for planting on a more extensive scale the following season. In these tests two types of plants, one from Sumatra seed and the other from Cuban seed, possessing the qualities, yield, and other characteristics necessary for a superior cigar-wrapper variety adapted for growing under shade were observed. These varieties have been shown to be improvements on previous varieties adapted for growing under shade, and seed for growing them on a commercial scale has been distributed in the Connecticut Valley, Florida, and other tobacco-growing sections.

In the following description of four new varieties of cigar-wrapper tobacco detailed descriptions and records of performance are omitted, these data being reserved for publication in technical bulletins of the Department. Short descriptions and statements of the value of these varieties are presented with a view to calling the attention of growers and breeders not only to their value but to the importance of breeding new varieties for the tobacco industry. In tests of these varieties by growers it is advisable that only a small area of any variety be grown until it is proved by experience that the variety is adapted to local conditions. It is also important that the growers save the seed of these varieties under bag, free from any possibility of cross-fertilization. The Department can not undertake to test the adaptability of these varieties in all of the different cigar-wrapper sections, so that it is necessary for the grower to use caution and test them carefully before planting them extensively on a commercial scale.

THE UNCLE SAM SUMATRA TOBACCO.

The original plants of this variety were found by the writer growing in a crop of tobacco under cloth shade grown by Mr. M. L. Floyd, near Tariffville, Conn., in the season of 1903. This crop was raised from seed brought to Connecticut from Florida and which originally came from the island of Sumatra. In this field of the so-called Sumatra variety of tobacco were found, upon careful investigation, 11 very distinct general types of tobacco plants which were strongly enough differentiated by certain characteristics of habit of growth, shape and size of leaves, and quality to be designated as incipient varieties. Among these types was found one which most nearly approached the ideal of a cigar-wrapper plant, both as regards development of plant and character of leaves, and strikingly different from every other type found in this field or in other fields. This was designated as "Type No. 3" for convenience in the breeding experiments, and was so known until it was considered of sufficient importance to be named.

The original field in which the first plants of this valuable type

were found consisted of about 40 acres, and contained a total of about 50,000 plants. Out of all of this number only 28 plants of the type known as No. 3 were found. It might be said here that the writer in all his experience in studying tobacco plants in other fields grown under shade in the Connecticut Valley, in Florida, and elsewhere, has never found a single plant which could be clearly classed with this type. On account of the few plants of this type found in the field and their very marked characteristics it was not considered likely that their seed would come true to type. However, on account of their valuable characters the seed of every plant was carefully saved under bag and great care was taken to prevent any possible cross-fertilization or accidental injury. In a violent storm late in the season one seed head, borne by one of the best individual plants, was broken off before the seed had matured sufficiently to admit of its being saved, so that the seed of only 27 plants was saved for experimental purposes.

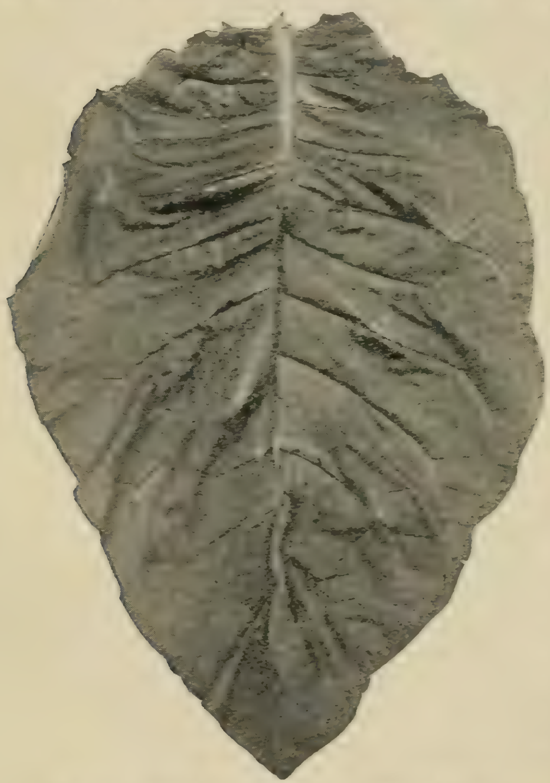

FIG. 11.—Typical leaf of Uncle Sam Sumatra tobacco.

In the spring of 1904 the seed of each of the 27 plants was sown separately in the seed beds, and about 100 of the seedlings of every parent plant were transplanted into test rows in the breeding field of Mr. J. S. Dewey, near Granby, Conn. To the surprise and gratification of everyone concerned it was found in the breeding field that the progeny of every parent plant as grown in the test rows came uniformly true to type, not a single plant of a foreign or different type appearing in any of the test rows. In the opinion of the many tobacco growers, plant breeders, and others who visited this field there has never been under their observation so striking an example of the uniformity of the progeny of individual parent plants in any crop propagated by seed. The habit of growth of the plants, the shape, size, color, and venation of the leaves, the number of

sucker branches, the arrangement and characters of the seed pods in the seed head, and the number of leaves of the individual plants in every progeny row were remarkably uniform and true to the type of the parent plants. The best plants in these test rows were selected for seed production and the seed was saved under bag. The tobacco produced in the test rows and by the individual seed plants was harvested separately in order to get an accurate laboratory test of the quality of the cured and fermented tobacco. After an examination of the fermented tobacco from the test rows and tests made for taste, burn, body, color, stretch, economy in cutting cigar wrappers, and other qualities, the seed produced by the most desirable plants in the five best rows was reserved for planting the following season. In 1905 tests of the progeny of individual plants were again carried out; seed was furnished the Bureau of Soils for a commercial field test in the Connecticut Valley and seed was sent to Florida and elsewhere for field tests. The results of these and other tests have proved beyond a doubt the value of this variety for growing commercially, together with the fact that the seed comes true to type year after year when saved under bag.

The name "Uncle Sam Sumatra" was given to this variety—a section of a field of which is shown in Plate XXXIII, figure 2—from the fact that it was found among plants grown in the United States from seed which was brought to this country originally from Sumatra. It is a cigar-wrapper variety of tobacco and adapted for growing under shade in the cigar-wrapper producing regions.

The plants of the Uncle Sam Sumatra tobacco reach an average height of about 8 feet at the time of maturity. The plants bear an average of about 26 leaves before topping. The leaves are borne in a characteristic slightly drooping position, as can be seen in the illustration (Pl. XXXIII, fig. 1). The color of the flowers and the size and arrangement of the seed pods are characteristic of this variety, very few pods being produced by the plants. Few and small suckers are produced, thus greatly reducing the labor of suckering the field crops. The plants grow vigorously, are resistant to unfavorable conditions, and are of early maturity.

The leaves are characteristically round (fig. 11) and specially adapted for economical cigar-wrapper cutting. The cured leaves will average about 16 inches in width by 20 inches in length, although the size varies according to the cultivation and fertilization of the soil, the location of the field, and other conditions. The size and shape of the leaves are very uniform from the top to the base of the plants. The green leaves have a deep-green color and the cured leaves a beautiful cinnamon-brown color. The veins are small and fine and regularly arranged in the leaves. The burn is excellent, leaving a gray, consistent ash, and the flavor is neutral, there being no disagreeable taste. On cigars the tobacco has a good life and stretch,

sufficient body or strength to withstand ordinary handling without injury, a dull gloss characteristic of the fermented tobacco, and a rich appearance desirable in all high-class cigar wrappers.

The yield of the crops of this variety is high, being as much as 1,600 pounds of cured tobacco to the acre under favorable conditions. The percentage of the best grades of wrapper in these crops is correspondingly high and satisfactory to the grower and manufacturer alike.

THE HAZLEWOOD CUBAN TOBACCO.

The crops of tobacco grown in the Connecticut Valley under cloth shade from imported Cuban seed in 1903 were extremely variable with respect to the type of plants. This variation in type of the plants grown from Cuban seed was not so marked as in the case of the plants grown from Sumatra seed, but there was found in the Cuban varieties a large proportion of worthless plants, apparent reversions or freaks, which were almost a total loss to the growers. Five distinct general types of tobacco were found in the crops of Cuban tobacco, and 340 plants of these types were kept for seed production, the seed being all saved under bag. Two of these types, numbered 11 and 13 temporarily for convenience in the tobacco-breeding series, were desirable for cigar-wrapper production, the plants of which constituted about one-fourth of the total number in the field in which the selections were made. Type No. 13 was specially desirable from a practical standpoint, the plants having the habit of growth, with freedom from suckers, and bearing the character of leaves necessary for producing a profitable yield of cigar wrappers. In the first seed selection of plants of this type, 32 typical plants were found after a careful examination of a field of about 48 acres grown under shade from seed imported from the island of Cuba. The seed of these plants, free from cross-fertilization, was carefully saved and tested the following year according to the methods employed in the tests already described.

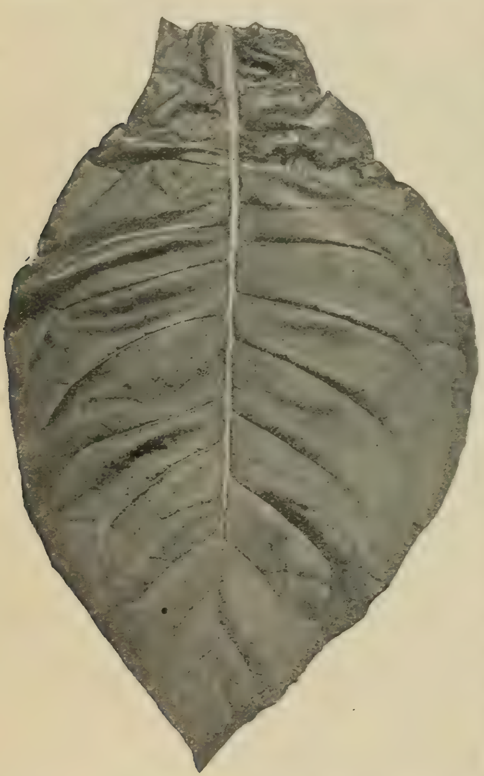

FIG. 12.—Typical leaf of Hazlewood Cuban tobacco.

FIG. 1.—TYPICAL PLANT.

FIG. 2.—REPRESENTATIVE FIELD, SHOWING MARVELOUS UNIFORMITY OF TYPE.

THE UNCLE SAM SUMATRA TOBACCO.

FIG. 1.—TYPICAL PLANT.

FIG. 2.—FIELD SHOWING UNIFORMITY OF TYPE, AND SEED OF BEST PLANTS SAVED UNDER BAG.

THE HAZLEWOOD CUBAN TOBACCO.

The transmitting power of the parent plants of this type was found to be very marked, the uniformity of the plants in the progeny rows in 1904 being very remarkable. In 1905 the bagged seed from the best plants in the best rows of 1904 was tested in a commercial field test in the Connecticut Valley by the Bureau of Soils, in further progeny tests, and in field tests in Florida and other cigar-wrapper tobacco regions. The results of these tests were so satisfactory that it was decided to give this type a varietal name and distribute limited quantities of seed to interested tobacco growers for use in 1906. The past season's tests have shown conclusively that this variety is valuable and an improvement on any of the Cuban cigar-wrapper tobaccos heretofore grown in the United States.

This variety (Pl. XXXIV) was named the Hazlewood Cuban in honor of Mr. William Hazlewood, who brought to the United States the original Cuban seed from which the variety was developed. It is adapted for growing under shade, and possibly to a limited extent outside, for cigar-wrapper production in the cigar-wrapper tobacco districts.

The plants of the Hazlewood Cuban variety when grown under shade reach a height of about 7½ feet at the time of maturity. The leaves have a partially erect habit of growth, the seed production is comparatively small, and the time of maturity is very early. The plants bear but few sucker branches (see Pl. XXXIV, fig. 1), differing in this very greatly from the ordinary Cuban varieties, in which the tendency to sucker production is usually very marked. The average number of leaves borne by the individual plants varies somewhat with conditions, but is about 21 after topping. The yield of the crops of this tobacco has been heavy for Cuban tobacco, reaching under favorable conditions 1,400 pounds of cured tobacco to the acre. The percentage of the best grades of tobacco in these crops has been high.

The leaves are about 18 inches in length by about 15 inches in breadth and are of a round shape adapted to economical cigar-wrapper cutting (fig. 12). The color of the green leaves is a very deep green, and of the cured leaves a velvety brown. The grain in the leaves is very marked, being evenly distributed from the tip to the base of the leaves. The veins are small and fine, the burn excellent, leaving a white to gray-colored ash, and the flavor is very good, no obnoxious taste being present. The tobacco has sufficient body and stretch so that when wrapped on cigars it stands handling without injury. When the plants are grown without shade the tobacco has a pleasant aroma and can be used for cigar-filler production.

THE BREWER HYBRID TOBACCO.

The Brewer Hybrid tobacco is the result of a cross of the Connecticut Broadleaf variety with the Cuban variety. This cross was

made in 1903 in the Connecticut Valley, plants of the Connecticut Broadleaf variety grown by Mr. N. S. Brewer, of Hockanum, Conn., being used for the mother parents and plants of Cuban tobacco grown in the Connecticut Valley from freshly imported Cuban seed being used for the male parents.

The object of making this cross was to secure a hybrid combining the characters of habit of growth, adaptability to Connecticut Valley conditions, burn, and other qualities of the Connecticut Broadleaf variety with the size and shape of leaves, grain, and texture of the Cuban tobacco. Twenty-six crosses of this kind were made, every one of which was successful, so that 26 seed pods were obtained. In 1904 the seed from all these pods was sown in separate compartments of the seed bed and the plants were transplanted to test rows in the experimental field. The plants in 6 of the test rows showed sufficient uniformity of characters to admit of further selection and breeding. The best plants of these rows were carefully selected for seed production and their seed was saved under bag. In one of the test rows the progeny of a parent plant numbered *1c* in the breeding records was found a striking plant, different from either parent or the other hybrid plants, but clearly approaching the ideal plant sought for. This plant was carefully tested in 1905 and found to come true to seed. The other progeny test rows this season showed considerable variability. Some of the rows were very much more uniform than others, but the important row was the progeny of the striking plant *1c*. The best plants in this row were selected for seed production and the seed was saved under

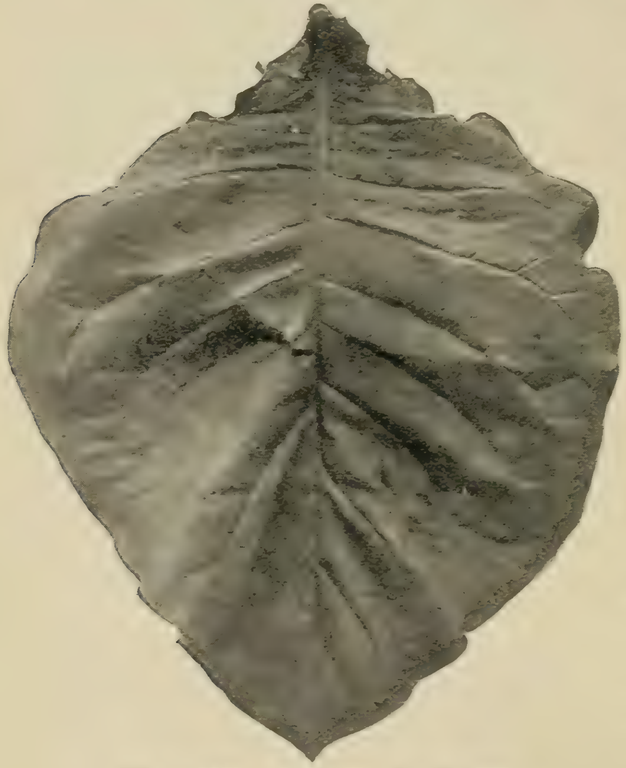

FIG. 15.—Typical leaf of Brewer Hybrid tobacco.

bag. In 1906 this seed was tested in a large number of localities, some of which were adapted to the production of this type of tobacco and others unfavorable to it. Under favorable conditions the crops were uniform and of desirable yield, and the tobacco of improved quality as compared with the parent Connecticut Broadleaf. While there is opportunity for further improvement of this variety by breeding and seed selection, its characteristics are sufficiently marked and desirable and the seed comes so true to type that it can safely be tested by tobacco growers who raise cigar-wrapper varieties of tobacco.

The name "Brewer Hybrid" was given to this variety (shown in Pl. XXXV, fig. 2) in honor of Mr. N. S. Brewer, of Hockanum, Conn., the grower of the parent Connecticut Broadleaf variety, who has furnished unusual opportunities for experimental work with this variety on his farm. It is adapted for growing in northern cigar-wrapper districts and for the production of cigar wrappers.

The plants of the Brewer Hybrid reach about 5 feet in height at the time of maturity, and the leaves have a slightly drooping habit of growth. (Pl. XXXV, fig. 1.) The plants bear about the same number of suckers as the Connecticut Broadleaf variety, although the character has as yet a tendency to vary under different conditions. The plants mature in about the same length of time as the Connecticut Broadleaf variety.

The leaves of the Brewer Hybrid are medium in size, averaging about 22 inches in length by 19 in width. The shape of the leaves is very round and especially well adapted for cigar-wrapper cutting (fig. 13). The grain is evenly distributed from the tip to the base of the leaves. The texture resembles that of Connecticut Broadleaf tobacco, but this tobacco when wrapped on cigars has a smooth, rich appearance not found in the Connecticut Broadleaf variety. The burn is good, leaving a gray ash; there is no bad flavor, and the stretch is particularly good, so that the tobacco on cigars stands handling very well. The color of the growing leaves is light green and of the cured leaves a bright cinnamon-brown. The fermented tobacco has the dull finish characteristic of Cuban tobacco. The yield of the crops is large under favorable conditions, reaching 1,800 pounds to the acre, and the production of high-grade wrappers in the crop is comparatively high.

THE COOLEY HYBRID TOBACCO.

The Cooley Hybrid variety of tobacco is the result of a cross between Connecticut Havana seed as the mother parent and Sumatra tobacco as the male parent. This cross was made in the summer of 1903, using Connecticut Havana seed plants grown by Mr. D. P. Cooley, of Granby, Conn., as the mother parents and Sumatra plants grown under shade in the same district for the male parents. The object of this cross was to secure a variety adapted to the conditions

of the Connecticut Valley, having the habit of growth, burn, and other characters of the Havana Seed tobacco, combined with the improved shape of leaves, venation, and other characters of the Sumatra tobacco. Eighteen flowers in carefully selected Havana Seed plants were cross-fertilized with Sumatra pollen, all of which set seed and were found to be successfully cross-fertilized. The resulting seed produced in the 18 seed pods was tested in progeny rows on the Cooley farm in 1904, 8 of which were determined upon careful examination and testing to be promising for future breeding experiments. In these 8 rows 3 plants of particular merit were found and reserved for a special test in 1905, together with many other plants, all of the seed of which was saved under bag. It was found that the progeny of the 3 particular plants saved in 1904 produced strikingly characteristic and uniform types of tobacco in 1905. (See Plate XXXVI, fig. 2.) The habit of growth of the plants, the shape and size of the leaves, and the quality and other characters of the tobacco of these progeny rows were so desirable that seed was saved from the best plants in 1905 for special field tests in 1906, as well as for continued breeding experiments. The final tests have demonstrated that under conditions favorable for the growth of the plants the variety is a valuable acquisition to the tobacco industry, and it was consequently named, and preparations were made for the distribution of a limited quantity of the seed for commercial planting.

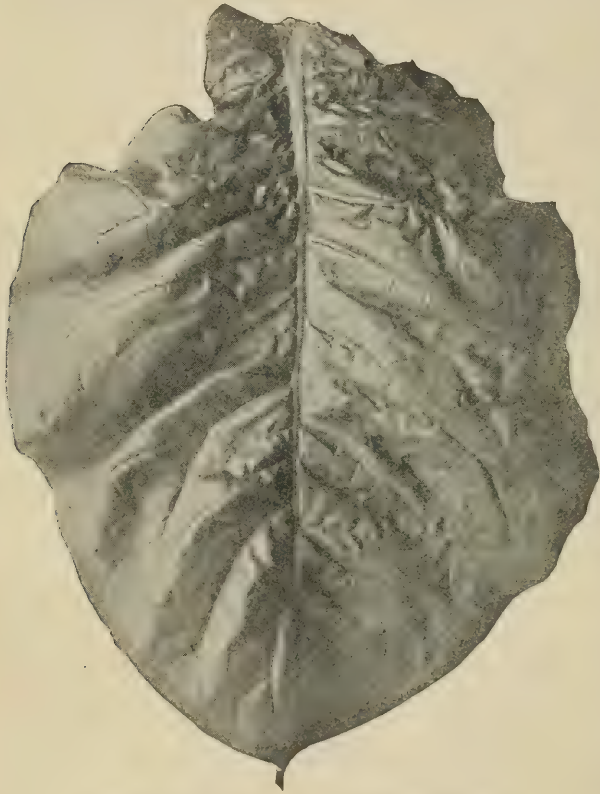

FIG. 14.—Typical leaf of Cooley Hybrid tobacco.

The Cooley Hybrid plants (Pl. XXXVI, fig. 1) grow to a height of about 6 feet, bear on the average about 21 leaves before topping,

FIG. 1.—TYPICAL PLANT.

FIG. 2.—REPRESENTATIVE FIELD, JUST AFTER TOPPING.

THE BREWER HYBRID TOBACCO.

THE COOLEY HYBRID TOBACCO.

FIG. 1.—TYPICAL PLANT. FIG. 2.—FIELD SHOWING UNIFORMITY OF TYPE.

have few small suckers, comparatively small seed production, and mature about the same time as the Connecticut Havana seed variety.

The leaves (fig. 14) are about 22 inches in length by about 17 inches in width, having in the growing condition a deep-green color and after curing a fine light-brown color. The venation is fine and regularly arranged in the leaves; the texture is uniform from the tip to the base of the leaves; the burn is good, leaving a white ash, and the flavor is satisfactory, no sharp or disagreeable taste being present in the fermented wrapper. When the Cooley Hybrid tobacco is wrapped on cigars it stretches well and covers the cigar in a satisfactory manner.

The yield of this variety under favorable conditions is about 1,750 pounds of cured tobacco to the acre. The yield of the best grades of wrappers is high, and this percentage can doubtless be increased by continued breeding and seed selection.

NECESSITY OF BREEDING EXPERIMENTS.

The object of the tobacco-breeding experiments undertaken by the Department of Agriculture is the production of improved varieties for the established tobacco-growing regions of the United States and for new sections of this country which are found to be adapted for tobacco culture. The great increase in the use of tobacco for the manufacture of cigars, smoking and plug tobaccos, and for other purposes has resulted in a demand which the areas now under cultivation adapted for the production of this crop have not been able to supply. This condition must be met either by extending and increasing the yield of the areas now cultivated in tobacco and developing new sections having the proper soil and climatic conditions for its successful culture or by depending upon increased importations of foreign-grown varieties.

It is an established fact that there are great areas in the United States not now growing tobacco which have the soil, climatic, and other conditions suited for growing valuable tobaccos and which for the welfare of American agriculture should supply the demand of the manufacturers. One of the most important phases of the development of these undeveloped sections is the production of varieties of tobacco adapted to their soil and climatic conditions. The experiments of the Department of Agriculture during the past four years have demonstrated that the production and introduction of such varieties can best be effected by the use of careful and systematic methods of seed selection and breeding.[a]

[a] The writer in the work of growing and testing the new varieties of tobacco described in this paper has been materially assisted by the active help and interest of Mr. W. W. Cobey and Dr. W. W. Garner, of the Bureau of Plant Industry, and of Mr. J. B. Stewart, of the Bureau of Soils.

In the old and established tobacco-growing regions of the United States it is a matter of common observation that the varieties of tobacco which have been continously cultivated in some of these sections have become more and more subject to the attack of certain fungous diseases, insects, and other enemies. The loss to the growers due to these injuries has become such that unless relief is obtained the industry in these regions must be abandoned. Two typical illustrations of this condition are found in the injury to tobacco plants in the Connecticut Valley by the fungous disease *Thielavia basicola*, or root-rot, and the destruction of plants in many fields in Florida and Georgia by the nematode, an enemy which threatens the success of this important tobacco-producing section. Varieties of tobacco resistant or immune to the attacks of some of these enemies have been produced in the course of the breeding experiments conducted by the Department, demonstrating the practicability of successfully combating fungous diseases and the attacks of insects through the origination of resistant or immune varieties by breeding and seed selection.

The variety of manufactured tobacco products due to the individually different tastes of consumers has resulted in the demand by manufacturers for particular varieties and grades of tobacco adapted for use in their specialties. The great number of brands of cigars, smoking mixtures, and plug tobaccos is sufficient evidence of the demand for different kinds of tobacco suited to the individual wants of the consumer. This demand has been met in part by the use of varieties of tobacco grown in different sections of the country, blending them in cigars or in smoking or plug tobaccos, and by the treatment of the tobacco while growing, or when undergoing the curing, fermenting, or manufacturing processes. The breeding experiments of the Department have proved conclusively that varieties of tobacco, adapted for particular purposes of manufacture by reason of their quality or other characteristics, can be produced by breeding, and can be propagated uniformly year after year by the use of proper methods of seed selection.

An illustration of the practicability and value of the breeding of varieties of tobacco for special purposes can be found in the varieties grown in the Connecticut Valley. As the result of breeding, the Havana Seed variety yields a high percentage of light-colored cigar wrappers having a smooth, glossy finish, while the Broadleaf variety produces largely medium to dark-colored wrappers with a rough and dull finish. One of the possibilities in this very important phase of tobacco breeding is the production of varieties of cigar-wrapper tobacco yielding uniformly throughout the crop leaves of particular size and shape adapted to the most economical wrapping of different sizes of cigars. Numerous other illustrations might be given to show

the necessity and importance to growers and manufacturers alike of producing varieties adapted for special purposes in all classes of tobacco.

METHODS OF BREEDING.

The methods of breeding employed by the writer in the production of new varieties of tobacco may be described under the general terms of hybridization and selection. Hybridization has been used for the purpose of combining in new varieties the essential and valuable characters of two established varieties by crossing, which necessarily has been followed by careful and rigid selection of the best individual hybrid plants for seed production every year. The term "selection," as used in these experiments, may be defined as the method of production of new varieties by saving the seed of mutations or striking variations in the type of plants found in the established varieties without artificial cross-fertilization. Such mutations, or "sports," may be the result of breaking up in type or of variability resulting from their being grown under new climatic or soil conditions, methods of cultivation, accidental cross-fertilization, peculiarity of season or food supply, or other cause.

From the fact that these breeding experiments were first undertaken and results secured with cigar tobaccos, the methods described will be those used in the production of new varieties of those tobaccos; but the same methods are being successfully used and are applicable to the production of new varieties of all other tobaccos.

HYBRIDIZATION.—The success of hybridization as a means for the improvement of tobaccos depends largely upon the judgment of the breeder in the selection of parent varieties and plants for crossing. In the first place, the crossing of widely different varieties of tobacco has given few, if any, valuable results. For instance, the crossing of varieties of cigar tobaccos with varieties of smoking tobaccos has not produced, so far, at least, a single improved type for either cigar or smoking tobacco manufacture. The crossing of different varieties of cigar tobaccos, however, has made it possible to secure improved varieties of this class. The varieties grown in this country may be grouped in a general way into three great classes, viz, cigar, smoking, and plug tobaccos. The experience of the writer is that crosses between the varieties *in any one class* may be beneficial, but that crosses between varieties of different classes are usually followed by failure.

It is absolutely necessary that tobacco breeders have clearly in mind the type of plant desired before any crossing of varieties is undertaken. Promiscuous crossing of different varieties of tobacco is certain to be unproductive of any valuable results. The best results have been secured by using an established variety for one parent and then crossing the best individual plants of this variety

with other varieties which possess the characters lacking in the first. It is important that a large number of crosses be made in order that the breeder may have an opportunity to find ideal plants for propagation.

In the Connecticut Valley, Broadleaf and Havana Seed are the two varieties which have been generally grown for cigar-wrapper production. The plants of these varieties produce large, pointed leaves, with coarse venation, which—on account of their size, shape, and venation—can not be economically used for cutting cigar wrappers. This tobacco, however, is adapted to the soil and climatic conditions of the Connecticut Valley, and has a good burn, taste, body, elasticity, and other valuable characters. The Cuban and Sumatra varieties of plants bear comparatively small, round leaves, with fine veins, but are not adapted for growing under the same conditions as the Connecticut Valley varieties. The crossing of the Connecticut Broadleaf and Havana Seed varieties with the Cuban and Sumatra varieties, followed by a rigid selection of seed plants for several generations, has produced several valuable and improved varieties of tobaccos. As a rule the best results have been secured by using a native or established variety as the mother parent and a foreign-grown variety for crossing as the male parent.

Selection.—Selection is the most practicable means for the production of new varieties of tobacco and is most likely to yield profitable and permanent results. Many of the established varieties may be traced to the selection of new types of plants in tobacco fields for seed production by tobacco growers. A well-known illustration of this method of production of new varieties is the White Burley variety, originated by George Webb, of Brown County, Ohio, and now grown extensively in Kentucky, Ohio, and other tobacco-producing States. The history of the origin of this variety shows that Mr. Webb, a successful tobacco grower, noticed in his field of Red Burley tobacco a few plants having a characteristic light-green color and peculiar habit of growth. These plants were saved for seed, and upon finding that the cured leaves of these plants were more valuable than the ordinary Burley tobacco the grower used the seed extensively the following season. In a few years the value of this tobacco was recognized by manufacturers and growers, and the variety was grown on an extensive scale. It is now one of the most important varieties grown in the United States.

The change of seed from one tobacco-growing region to different soil and climatic conditions, particularly from the South to the North, is likely to result in the breaking up of the type of the variety and the appearance of plants with characteristics very different from the established type. These new types of plants can be propagated by using self-fertilized seed, and uniform varieties of tobacco can be

secured by continued selection of the best individual plants for seed production. The use of Florida-grown and imported Sumatra seed for growing in the Connecticut Valley during the past few years is a good illustration of the effect of a change of seed. The plants grown from this foreign-grown seed were extremely variable, individual plants of new and unknown types of tobacco appearing in the fields. The seeds of desirable individual plants of these types were saved under bag, free from cross-fertilization, and several valuable new varieties have been secured adapted to the conditions in the Connecticut Valley and uniformly coming true to type year after year.

It is a matter of common observation among tobacco growers that an occasional plant producing the ideal leaves and other characters desired by the growers and manufacturers is found in their fields. A lack of appreciation of the value of these plants for breeding purposes results in their being topped and thus lost for seed production and propagation. It is the belief of the writer after several years of careful observation along this line that if tobacco growers could be interested in carefully studying their crops from the time the plants are set out in the field until they are topped, for the purpose of finding these occasional plants of the ideal type and saving their seed under bag, free from accidental cross-fertilization, for planting the following season, more progress could be made in the production of improved varieties of tobacco than by any other means.

THE TESTING OF NEW VARIETIES.

The value of new varieties of tobacco must be established by careful experimental tests as well as practical experience before they are introduced for growing on a commercial scale. This feature of the successful production of new varieties is of special importance with this crop, because the value of varieties of tobacco depends not only upon their quality, yield to the acre, and economical use by manufacturers, but also upon the reputation established by years of successful production for a particular market requirement. The consumer of tobacco does not easily change from one kind of tobacco to another, after finding a satisfactory article, and consequently the manufacturer is slow in making any change in the variety used for making particular brands of cigars, smoking mixtures, plug tobaccos, or other manufactured products. It is therefore important that the breeder make all possible tests of the value of new varieties before distributing the seed to tobacco growers.

The new varieties of tobacco produced by the Department of Agriculture are tested in the field for habit of growth and yield; in the laboratory for the quality of the cured and fermented product; and finally samples of the tobacco of these varieties are subjected to actual manufacturing tests by manufacturers.

Field tests.—The field tests must necessarily be conducted in those sections and under those circumstances in which the variety is to be grown. The influence of soil and climatic conditions upon the behavior of the tobacco plant is such that the results obtained in one section of the tobacco-growing regions can not be depended upon for other sections having different conditions.

In the tests of cigar-wrapper varieties a 1-acre field is considered large enough to secure the necessary data as to the uniformity of the individual plants in the field, yield, and other characters that can not be determined by row tests in the breeding experimental fields. The area devoted to the field test, however, must frequently be modified by circumstances, but less than an acre is likely to be unsatisfactory, owing to the fact that in such cases not enough tobacco of any one grade can be secured for entire bales or packages. The larger the area that can be used for such tests, other things being equal, the more valuable and reliable the results from the practical standpoint.

In the field tests of new varieties of tobacco every phase of the culture of the crop—from the time the carefully selected seed is sown in the seed bed until the tobacco is harvested, cured, and fermented—should be so arranged as to give the crop the most favorable circumstances possible for growth. In all cases, however, the amount of money expended for any and all operations must be governed by practical experience of growers of other varieties of tobacco in the same class as the experimental crops. The results of these experiments, to be of value, must show the profit under practical conditions of field culture of the new varieties compared with the established varieties; or, in sections where tobacco has not been grown, the profit that may be expected by growers under normal conditions. A record of the actual cost of all of the operations in the production and handling of the crop, the yield, and the selling value of the product is necessary in order to determine the comparative or actual value of the new varieties.

Laboratory tests.—The laboratory tests of new varieties of cigar tobaccos include a study of the tobacco during the curing and fermenting process in the warehouse, and an examination of the color, burn, body, elasticity or stretch, and flavor and aroma of the fermented leaves. As an illustration of these tests the character of the burn of the Department's new varieties is tested in the smoking machine devised by Dr. W. W. Garner,[a] of Plant Breeding Investigations, supplemented by other tests, including the ordinary tests of the tobacco buyers. The elasticity and strength of the leaves are determined by the aid of a specially designed apparatus for this purpose, and finally representative samples are made up into cigars and

[a] See Bul. 100, Part IV, of the Bureau of Plant Industry, "Methods of Testing the Burning Quality of Cigar Tobacco."

submitted to experts for a test of the flavor, aroma, and other characters necessary for a desirable tobacco.

Manufacturing tests.—The manufacturing tests of new varieties are made by sending representative samples of the fermented tobacco to manufacturers for use in the products for which the varieties are adapted. The final test of the value of any tobacco is its usefulness in filling the demand of the manufacturer; therefore this test is of supreme importance from the standpoint of securing reliable information as to the desirability of growing a variety extensively. Tobacco manufacturers are, as a rule, anxious to test new varieties with a view to securing a more valuable tobacco for their established trade or for the purpose of supplying the demand for other products for the manufacture of which the established varieties are not adapted. It is a common practice, therefore, for manufacturers, through their buyers, to purchase small crops of new varieties and test them in comparison with their regular supply of tobaccos. In this way the tobacco breeder may get a practical test of new varieties, and if they prove valuable the demand of the manufacturer will encourage increased production.

THE PRESERVATION OF TYPE.

The production and introduction of new varieties of tobacco must be followed by continued effort on the part of the growers to preserve and improve the type, in order that the fullest and best results may be obtained. Without selection of seed plants year after year by the growers, the life of tobacco varieties is comparatively short. The accidental cross-fertilization of seed saved without protection, the use of inferior plants for seed production, and many other causes contribute to the deterioration, breaking up of type, and so-called running out of varieties. This fact is so well established that growers find it necessary frequently to secure seed from some new source rather than to use their own tobacco seed. In view of the fact that the profitableness of a variety depends to a considerable extent on the production of a uniform character of tobacco year after year for a particular purpose, the importance of preserving the type of the variety can not be overestimated.

The uniformity of varieties of tobacco can be effectually controlled by protecting the seed of carefully selected plants from accidental cross-fertilization and by seed separation. The best individual plants of the variety grown should be selected for seed production. The variability of the individual plants in the field offers an opportunity for the continual improvement of a variety by the intelligent selection of seed plants having the habit of growth and bearing the character of leaves most nearly meeting the ideal of the grower and the needs of the manufacturer. The flowers borne by these seed plants can be

successfully protected from cross-fertilization with the plants in the same field, or of other fields or varieties, by inclosing the flower heads of the selected plants, before the flowers open, with a light but strong manila-paper bag. The tobacco flowers are perfectly self-fertile, and several years of extensive practical experience have shown that tobacco seed saved under bag—that is, self-fertilized seed—is equal if not superior to seed cross-fertilized within the variety. These paper bags should remain over the seed heads until all of the flowers have set seed, as shown by the development of seed pods; then they can be removed and the seed allowed to mature under natural conditions. In northern districts it has not been found necessary to remove the bags, and they may be left over the seed heads until the seed is shelled. In southern districts it has not only been found advisable to remove the paper bags, but it is an advantage, before using the bags, to perforate them with small holes, as with a needle, to admit of a circulation of air without danger of cross pollination. The paper bags prevent the cross-pollination of the flowers under the bag by wind, insects, or other agencies.

The methods of bagging the seed, seed separation, and, to a limited extent, the row test, outlined in this paper and more fully described in the Yearbook for 1904,[a] have been extensively adopted by tobacco growers of established varieties. The use of these methods of breeding as a means of preserving the types of new varieties of tobacco is of very great importance and should receive the attention of every grower.

CONCLUSION.

The experience of the writer during the past four years has shown that breeding experiments systematically carried out can be made of great practical importance to the tobacco industry. It costs no more to grow an improved variety of tobacco giving a higher yield of a better quality than to grow unimproved and irregular varieties. The tobacco plant is particularly susceptible of improvement and satisfactory for the work of the breeder in that it is both fully self-fertile and easily cross-fertilized. The large number of seed produced by single plants, frequently a half million or more, makes the propagation of a valuable variety, once it is secured, particularly easy and rapid. The active interests of the manufacturers in the production of improved varieties adapted to their needs and the willingness of the manufacturers to pay increased prices for better qualities in improved varieties make tobacco breeding remunerative to the grower.

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[a] Shamel, A. D., Yearbook of the U. S. Department of Agriculture, 1904, p. 435, "The Improvement of Tobacco by Breeding and Selection."

OPPORTUNITIES FOR DAIRYING.

I. GENERAL.

By Wm. Hart Dexter, Ph. D.,
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DEFINITION.

Strictly speaking, dairying is the business of conducting a dairy farm. Commonly, however, we use the word to include the varied industries which have to do directly with the production and handling of milk and milk products. The industrial salvation of this country depends ultimately on its agricultural resources. The profits of agriculture depend ultimately on the intelligent cultivation of the soil. Dairy farming is increasing in almost every section of the country, largely because it is recognized as one of the most economical forms of agriculture where the preservation of soil fertility is considered. Taking this broad view of dairying, we find it one of the greatest wealth-producing industries in the land.

Opportunities for dairying are found everywhere in the United States. The different sections of the country have characteristic peculiarities, but all need milk and its products. Success awaits the dairyman who fits his work to the conditions of the place in which he lives. He should know the value of a good dairy cow and how to treat her. He should recognize the necessity of cleanliness from the time the milk leaves the udder until the finished product is in the hands of the consumer. He should know and meet the needs of his market.

OPPORTUNITIES IN VARIOUS LINES.

The equipment and practice found on the dairy farm afford great opportunity for improvement. Better buildings as to construction and sanitation need not be expensive. The best machinery and utensils are available at moderate prices. Thorough and cleanly management in the stable and milk room is simple and cheap. The necessary refrigeration can also be provided without elaborate or costly fittings. The indispensable silo can be erected of such material as may be best suited to the climate.

The maintenance and increase of soil fertility constitutes one of the greatest opportunities for dairying. A ton of wheat, worth $22,

removes from the soil $7.50 worth of plant food. A ton of butter, worth $500, takes less than 50 cents' worth of plant food from the soil. Land on the Pacific coast, reduced to such poverty by the continued raising of wheat that it produced only 8 or 9 bushels of wheat per acre, has been so restored by dairying that it now produces from 20 to 40 bushels, and the land has doubled in value.

Careful dairying goes hand in hand with the most helpful rotation of crops, encouraging especially the production of legumes. Diversified farming needs dairying for its best results. The improvement of the forage crops best suited to a given locality is the natural study of the dairyman.

IMPROVEMENT OF DAIRY CATTLE.

The improvement of dairy cattle offers great opportunity. The cows supplying Iowa butter factories are making an average of only 140 pounds of butter per year. By the weighing and testing of the milk of each cow those which fail to pay their board can be detected and rejected. The rearing of the heifer calves from the most profitable cows is the simplest course for the improvement of the herd at least expense. In this selection regard must be had for dairy type of form and function. A pure-bred dairy sire should be at the head of every dairy herd. It is entirely practicable to add largely to the wealth of every dairy farmer in this way, and every dollar added to the average income from the dairy cow in the United States adds $20,000,000 to the nation's production of wealth.

To assist in this improvement of the dairy herds cooperative test associations have been organized. They were introduced ten years ago in Denmark, and are now found in most of the prominent dairy sections of Europe. In Germany these associations have been the means during the last five years of increasing the income of the dairy farmers by an average of $14 per cow per year. Similar associations in a few States of our own country, led by Michigan, have shown the practicability of increasing the income from dairy farming at least one-fourth without additional expense to the producer. Cooperation in the organization and management of these test associations is needed to promote their practical and general efficiency.

The associations of breeders of pure-bred dairy cattle have a similar opportunity to increase the value of their records of tests of dairy cows. By agreeing upon uniform rules under which these tests should be conducted, general standards of dairy performance would be established, and by the registration of all such records in a national office their general acceptance and use would be secured.

IMPROVEMENT OF DAIRY PRODUCTS.

Opportunity for dairying appears also in the increased demand for pure milk, especially in the larger cities. This opportunity is for

intelligence and cleanliness in the production and for reliable purity in the product. The market-milk producer can now profit by improved methods for the care, distribution, and sale of milk of the best quality. There seems to be practically no limit to this market.

On many dairy farms near cities and places of popular resort opportunity for profit is afforded by the demand for ice cream. One great advantage in supplying cream is the saving of the skim milk for the feeding of farm stock and ultimately for the fertility of the soil.

Farm dairy butter of the highest quality is always in demand at the highest prices. Uniformity of excellence must be maintained, and this requires patient attention to details. Success in this line will follow the use of the improved methods which have been worked out in the creameries, with such modifications as may be required in the smaller operations of the farm. The new rapid method for the determination of water in butter will be of material assistance. Taints and defects must be promptly discovered and corrected. The farm separator must be kept clean.

The furnishing of fancy farm-made cheese offers an opportunity for great profit. Recent investigations have shown that it is entirely practicable to produce in this country the finest grades of cheese of the Camembert and Roquefort types, heretofore only had by importation from Europe. Prices for such goods are high, and the farm dairy can easily be equipped for their production.

There is large opportunity for profit in dairying by the improvement and varied uses of the by-products from the manufacture of butter and cheese, such as casein, ash, and milk sugar. While some forms of these by-products require expensive machinery, others are entirely within the reach of the farm dairy. Under present conditions, however, the most profitable use of skim milk and whey is as food for farm stock and poultry.

CONTROLLING MOTIVES.

In fairly estimating the advantages of dairying one should consider the opportunities presented for the legitimate gratification of the strongest and best motives to action. The best dairyman is the one who is most effectively controlled by such motives.

The desire for profit is strong. A Connecticut dairyman makes 22 per cent net profit annually on his investment. In Georgia one acre and one dairy cow have produced in one year, under careful management, a net cash profit of $28.75 in addition to $20 worth of manure contributed to the fertility of the soil. The dairyman's income is conveniently distributed throughout the year, enabling him to keep out of debt. Supplying home markets keeps money at home. There is no danger of overproduction with the world for a market.

The desire for leadership is strong. It may be gratified in the

organization and management of dairy enterprises. There is opportunity for leadership in plans of cooperation connected with creameries, test associations, State experiment stations, and the improvement of the condition of the rural community.

The desire for knowledge is strong. The dairyman has opportunities for the search after truth in scientific investigations concerning the soil, the culture of forage crops, the breeding and care of live stock, the chemistry and bacteriology of milk products, and the principles involved in the invention and use of machinery.

The desire for pleasure is strong. The dairyman has opportunity for pleasures of the better sort, in the enjoyment of the poetry and beauty of rural life at its best. He may enjoy the improvement of the farm home. Love for animals finds pleasure in their daily care. The endeavor to supply the best of pure food gratifies love for his fellow-men, the highest of merely human motives.

II. NEW ENGLAND.

By George M. Whitaker,
Dairy Inspector, Bureau of Animal Industry.

PASTURES AND GREEN FORAGE.

New England offers exceptional advantages to the dairyman. The leading crop in the feeding of cows is grass; and the soil and climate of New England are such that grass grows readily. The strong, retentive clay soil of the hillsides is excellent grass land, producing large crops of hay with ordinary care. Grass also grows naturally; and many hills, too rough and rocky for cultivation, will grow wild grasses if the ever-encroaching bushes are kept back. In these pastures of low-priced land many cows and young stock get their summer living at very little expense to the owner. The crop of second importance is the corn plant, which is grown more for forage than for the grain. It grows well in almost every section, and responds readily to cultivation and fertilization. It is frequently fed green from the field, as the pastures begin to dry, in order to keep up the flow of milk. Large amounts are cut for the silo, grain and forage both going into the pit. The geological formation in many parts of New England is such that an abundance of pure water gushes from thousands of mountain springs. There are likewise excellent opportunities for getting ice of the best quality, which almost every dairyman puts up for his summer use.

MARKETS.

New England's second distinctive advantage is in excellent, well-located markets. Her surface is liberally dotted with manufacturing

towns and cities where reside a large part of her population. New England, with only one-fiftieth of the area of the contiguous United States, has one-fourteenth of the population. According to the census of 1900, Rhode Island is the most densely populated State in the Union, having 407 persons to the square mile. Massachusetts, though forty-fourth in territorial rank, is seventh in amount of population and second in density of population among the States and Territories of contiguous United States. Connecticut ranks fourth in density of population, while New Hampshire and Maine, though further down the list in this respect, have a number of large manufacturing cities and towns.

But the superiority of New England's markets for dairy products is not told wholly in statistics of a large population located on a comparatively small area. The purchasing ability of this population is large, as it is largely composed of well-to-do merchants, professional men, and skilled mechanics. Even the unskilled common laborers have steady employment at good wages and consume large amounts of dairy products.

Such markets mean a quick demand for all dairy products. Aside from milk and cream, New England does not produce all the dairy products she consumes. Hence there is always a good demand for the fresher article produced near by. The New England dairyman has an advantage as to price. Even in the wholesale market New England butter is usually quoted at one or two cents above western. But many dairymen are located so that they can sell milk, cream, or butter in a near-by market or direct to consumers, thus getting the further advantage of a retail price. And few New England dairymen are located so far away from a center as to be out of reach of the milk car to the city, the cream gatherer for some butter factory or cream-shipping station, or the cheese factory. The producer of milk and its products in New England is closer to the consumer than in other sections.

Not a few New England dairymen are so favorably located and have so much skill that they get an advance above the ruling price for an article of extra quality.

DISADVANTAGES.

The disadvantages of New England dairying are a comparatively sterile soil, cold winters, relatively short growing seasons, rough, rocky topography, and high freight rates on small shipments for short distances. But the quality of the market offsets these to a large degree. Thorough cultivation and plenty of applied plant food make the land under cultivation produce large crops. Four tons of hay per acre is frequently harvested, though this is above the average, and 6 tons is no uncommon production. High yields of ensilage corn are common.

RELATIVE IMPORTANCE OF THE DAIRY INDUSTRY.

Dairying is the leading agricultural specialty in New England. Market gardening receives much attention near the cities and large towns, but many market gardeners keep a dairy herd to consume the refuse from the truck garden and to increase the size of the manure pile. Fruit growing is also a specialty with many, but even in those cases dairying is often a side issue of importance. Hence dairying is almost universal. All the leading breeds of dairy cattle are represented by pure-bred animals of high quality. Some of the famous pure-bred dairy stock of the country is of New England ownership or origin. All of the leading national breeders' associations have many New England members, two have come to New England for secretaries, while prominent officers of others are New England men.

Market milk is the leading feature of New England dairying. Milk cars for Boston every morning leave northern New Hampshire, central Vermont, western Massachusetts, and central Connecticut. Between thirty-five and forty carloads of milk arrive at Boston daily, almost all being of New England origin. The supply of milk for the smaller cities is also a business of large dimensions. The increasing use of cream makes that product of second importance. Maine sends a carload of cream to Boston daily, while large quantities are received from other sections along with the regular milk supply. Much of this market cream is separated by the farmers either by the Cooley process or the centrifugal separator, gathered by creameries, where it is run through a separator for standardizing, and then shipped to the city in bulk.

In northern New England much butter is made. All the butter produced in New England is consumed while it is comparatively fresh—in many instances while it is only a week or two old. Cheese production is no longer prominent in New England, although many factories still exist in Maine and Vermont, and many private dairies still manufacture cheese.

Among methods characteristic of the section perhaps the use of the Cooley creaming system is the chief. The Cooley system of cream gathering was of New England origin, and the apparatus has always been of New England manufacture, so that this particular method gained such a strong foothold there that the separator has not yet supplanted it, although many separators are now in use and the number is yearly increasing.

NEEDS OF NEW ENGLAND DAIRYMEN.

The needs of New England dairymen are chiefly those common to dairymen generally: (1) Improvement of methods; (2) elimination of cows that do not pay their board; (3) more attention to the little

details of cleanliness; and (4) more of a spirit of cooperation and less cutthroat competition, particularly in the selling of milk.

The needs of dairying which seem to be peculiar to New England are four. The first is an appreciation of the good markets in this section. People generally see at close range the hard work and perplexities of their own business, and have a vivid realization of them; hence it often happens that one is a poor judge of the relative advantages of his occupation. New England dairymen are no exception to this rule, and they lose sight of the broader and relative side of their business. More appreciation of the advantages of the situation would lead to better utilization of it.

A second need of New England dairying is more attention to the pastures. Here can be obtained, at a merely nominal expense, large amounts of the very best cow feed. Yet it is the common testimony that on the whole the pastures of New England are retrograding; the coarse weeds, bushes, and encroachment of the forest are driving out the native nutritive grasses.

The third need is more attention to growing legumes. The New England dairyman is to-day dependent upon the West for most of the nitrogenous element in his cow rations, this being bought in the by-products of the factories which handle grain either for grinding or the manufacture of "breakfast foods," glucose, and other articles. If the New England milk producer raised more clover, peas, and other legumes, he would be more independent; his farm would be more nearly self-sustaining; it would increase in fertility, and his dairy products would cost less. Several dairymen have experimented with alfalfa, which in some cases has promised well for a few years, but no permanent successes are as yet reported. The experiment stations are doing good work in introducing vetches, rape, and soy beans; but in the common old-fashioned red clover farmers have a convenient and valuable legume.

The fourth need is the doing of business, in most cases, on a larger scale, making it possible to practice some of the economies which come from wholesale methods of production and selling. Too many go to market with such small amounts of butter as to be compelled to accept whatever the village trader may offer.

THE OUTLOOK.

As long as business is prosperous and population continues to concentrate in the cities and towns, requiring them to reach out farther and farther for supplies of fresh milk, the market-milk business will crowd back the making of butter and cheese, especially of the ordinary grades; and factories for their manufacture will be abandoned in order to sell milk or cream to the city. The outlook, therefore, for the market-milk business, as far as demand is concerned, is good. The

only question is that of price. The farm-labor situation is acute, the cost of grain feeds is high and increasing, and the awakening of health authorities to the importance of clean, sanitary milk is adding to the cost of production. There seems to be no danger of the overproduction of milk, cream, or fancy fresh butter.

We may conclude with the statement of Prof. W. A. Henry: "The eastern farms, for inherent beauty, for all that goes for home-making, for possibilities in the range of crops, and for good markets, are without a rival anywhere in the world."

III. THE NORTH CENTRAL STATES.

By B. D. White.

Expert in Dairying, in Charge of Building and Management Investigations.

RECENT PROGRESS.

Wonderful progress has been made in the dairy industry during the past decade, and many changes have taken place, especially in the North Central States. Among the States which have become prominent in dairying recently are Michigan, Indiana, North Dakota, South Dakota, Oklahoma, and Missouri. Northern Oklahoma and Missouri are especially adapted to dairying.

In the last fifteen years the States of Illinois, Iowa, Wisconsin, and Minnesota have made great progress in dairying. In the last two States thousands of farms have been taken up and put under cultivation, and hundreds of creameries and cheese factories have been built and put in operation, manufacturing the milk or cream from hundreds of thousands of cows into prime butter or cheese. There is yet much untilled land not only in those States but in many others in the Middle West waiting to be converted into fine farms.

FAVORABLE CLIMATIC CONDITIONS.

There seems to be a belt particularly favorable to the dairy industry in the North Central States. This belt extends from Ohio west to the Missouri River slope and to the arid region east of the Rocky Mountains. Some profitable dairying, however, is carried on in all the Western and Southern States, but thus far it has not been made a common adjunct to general farming as it has in the North and East.

The northern climate seems to be conducive to dairying. The farther north we go the more dairying we find, until the pine-timbered region is reached. Even this is being converted very rapidly into dairy farms. Silage has come to be recognized throughout this section as the cheapest possible kind of roughage in a succulent and palatable form. Another northern condition favorable to dairying is the abundance of fine natural grasses and the adaptability of the

soil to clover, especially in the timbered sections of Wisconsin and Minnesota. The coolness of the nights in summer also makes it possible to keep milk and cream easily, and this makes the work of dairying more agreeable. Even the necessity of giving stock proper protection during the winter months tends indirectly to increase dairying, and especially winter dairying, which the northern farmers have found to be the most profitable.

The reasons for the greater profit in winter dairying are not hard to find. Higher prices are paid during the winter months for milk and cream. Cows freshening in the fall will, if properly fed, give milk all winter, and when turned out to grass in the spring will give practically as much milk as when fresh. Farmers have more time in winter to do the work required for dairying. Calves may be fed on skim milk during the winter months, and when turned out to grass in the spring need very little more care, and the skim milk may then be fed to the spring pigs. Under the system of winter dairying, cows go dry in July and August, at a season of the year when the farmers have the most work to do and the least time to give to the care of cows and calves.

SOIL CONDITIONS.

The soil throughout the dairy districts of the North Central States is generally good, except in a few localities which are sandy; but on account of the large number of cows and other animals kept, the fertility even of the poorer soils is kept up, and such crops as are necessary for the maintenance of a dairy herd are raised. In sections where a portion of the land is too rolling or hilly to be fit for the growing of crops it is used for pasture, and only the lower land is used for tillage. In other localities, where lakes abound, the land near the shores for a certain distance is too wet for cultivation, but makes good pasture and is used for that purpose. In such localities also the stock is well supplied with water; hence both the high land and the low is used to good advantage for stock raising and dairying. Throughout the localities where dairying and stock raising are extensively carried on the fertility of the soil has not only been kept up, but in many sections it has been largely increased.

DAIRY COWS.

It is with regret that one must say that a large percentage of cows throughout the North Central States are yielding only a trifle more than 100 pounds of butter each per year. In some dairy States the average yield is less than 150 pounds per cow per year, when it is possible, under quite ordinary conditions and with grade cows of dairy breeds, to produce twice that amount. Evidently there is plenty of room for improvement. By proper selection, care, feeding, and breeding of dairy cows the output of dairy products can be doubled

without increasing the number of cows now in the country. On many farms the dairy herd could be made to produce an increased profit simply by testing all the cows and disposing of those which are proved to be unprofitable.

The increase in the number of cows is noteworthy. Take Minnesota as an example. The number of cows supplying creameries increased from 382,356 in 1901 to 458,466 in 1904. Considering the average cow worth $30, the assets of Minnesota dairymen were thus increased 2¼ million dollars in these three years, besides the amount obtained from the sale of young stock.

In Iowa the number of cows supplying creameries increased from 600,000 in 1905 to 650,000 in 1906.

MILK.

The center of butter production has been gradually moving westward, while market milk is relatively of less importance westward than in the East. Eastern cities are learning the value of milk and milk products for food. The agitation by boards of health for cleaner and purer milk seems to have stimulated the demand, and difficulty is experienced in most of the large cities in obtaining an adequate supply of milk and cream during the winter season, though prices are higher to the consumer than in former years. Condensing factories are using large quantities of milk, which in its condensed form is shipped to nearly every country on the globe. A considerable quantity of milk is being used in the manufacture of fancy brands of cheese.

It has been estimated that skim milk is worth from 15 to 25 cents per hundred pounds for feeding purposes on the farm. It is difficult to estimate the total feeding and fertilizing value of skim milk to the farmer. Without it less stock will be raised on the average farm. With less stock there will be less manure, and the fertility of the soil will decrease year by year until the land has reached such a stage of poverty that it will no longer produce profitable crops. Farmers should receive at least 25 cents per hundred pounds for skim milk sold from the farm. Even where that price is received, the average farmer does not invest an equal amount, as he should, in commercial fertilizers. When more stock is kept and the skim milk fed to it, the fertility taken by the crops is replaced and the land kept in proper condition. The farmer of the North Central States is learning this lesson. The price obtained for milk in these States is not as high as in the East, but the net profit seems to favor the western farmer, as he is able to produce milk more cheaply on account of the abundance of feed which can be raised on his fertile soil.

BUTTER.

Western methods followed in the manufacture of butter are worthy of note. The system of delivering fresh sweet milk daily to the butter

factory, which was the common practice after the discontinuance of the gathered-cream system, has been largely changed. The farmers have bought separators, and they now skim the milk at home, feed the fresh warm skim milk to the stock, and deliver only the cream to the factory. This is the ideal system from the farmer's standpoint, but new obstacles have appeared which tend to lower the quality of the butter made. The farmers do not deliver the cream as often as they should, because many butter factories will accept cream which is no longer sweet.

Many factories also solicit cream shipments from farmers, either direct to central plants or to receiving stations at points on railroads, from which it is forwarded to the central or churning plants, in some cases hundreds of miles from the source of supply. At these stations or central plants cream is received in any condition, without regard to age or quality. On account of the poor quality of butter made from such cream and the cost of transportation, the price to the farmer has been during the past season about 4 cents per pound less for butter fat than is paid at the creameries where the cream or milk is delivered sweet, so that it can be made into a first-class article of butter. A loss of 4 cents per pound for all the butter fat delivered to creameries for butter-making purposes in six of the largest dairy States would mean a loss of about 13 million dollars per year, or a loss of about 3½ million dollars in such a State as Iowa, Minnesota, or Wisconsin.

The manufacture of butter seems to be increasing rapidly, especially in the sections where the cooperative system prevails—in Wisconsin, northern Iowa, and Minnesota. The creameries in Wisconsin, as reported by the State authorities in 1900, made 60,000,000 pounds of butter, and in 1905, 88,500,000 pounds. The increased creamery production has not decreased the amount of butter made upon the farms, which, according to reports, in 1900 was 25,000,000 pounds, and in 1905, 34,500,000 pounds.

In Iowa the product of butter has increased from 77,000,000 pounds in 1900 to 91,000,000 pounds, which sold for more than $20,000,000, in 1905.

Minnesota shows an increase from 44,000,000 pounds in 1900 to 77,000,000 pounds in 1905. In other States proportional increases have probably been made.

There has been increase during the last year in nearly every particular. The number of smaller centralizing plants has increased, as have the number of the dairy farmers and the size of their herds. The per capita product of the cows has increased and with it the demand for cattle of the dairy breeds.

From the increased production we are led to ask the question: What effect does the increased production have upon the price? The

census reports give the total number of pounds of creamery butter made in the United States in 1899 as 420,126,546. The amount of butter of all grades exported for five fiscal years ending with 1900 was 114,923,530 pounds, at an average price of 15⅗ cents per pound. The amount of creamery butter made in 1904 was 531,478,141 pounds, and the amount exported for the five years ending with 1905 was only 68,931,172 pounds, at an average price of 17⅓ cents per pound. The average price of extra creamery butter as quoted in New York for the five years ending with 1900 was 20.3 cents per pound, and for the next five years 22.24 cents per pound, which indicates that the demand for butter at home has increased at a greater rate than the production, causing an advance in the price. At the present time a large proportion of the extra creamery butter sells at a premium of 1½ to 2 cents per pound above the quoted prices.

From present indications it would appear that the outlook for the dairy industry, especially the production of butter, in the North Central States is bright. The increased demand for milk and cream for direct consumption, with the increase in population, will have a great influence on the consumption of butter at home. Another hopeful sign is the probability of increasing exports to Cuba, which has been largely supplied by Denmark, and to European countries which have been largely depending upon other nations for their supply of butter.

The butter exported from the United States has heretofore been principally of an inferior quality. The demand at home has taken all of the better grades at good prices. It is only natural to expect that a large percentage of the butter made in this country will hereafter come from the North Central and Southern States and that there will be an increasing demand for the best grades.

CHEESE.

Throughout the North Central States there has been a steady increase during the last five years in the production of cheese, as well as butter, but the amount of cheese made is less than the amount of butter, except in Wisconsin, where more cheese is made. In 1900, 78,000,000 pounds, and in 1904, 109,000,000 pounds were made in factories in that State. The percentage of increase in other States has in some cases been as large as that of Wisconsin, which is the largest cheese-making State among the North Central States.

Recent investigations have led to the use of improved methods in the manufacture of cheese. Many of the causes for the poor quality of the cheese previously manufactured have been learned and corrected. By the cold curing and ripening of cheese a more uniform article is produced, and it is commanding an increased price as consumption and demand increase.

In some of the North Central States which have not yet undertaken the manufacture of cheese there are excellent opportunities for profitable production to supply the increasing local demand. In localities where there is not enough milk for the profitable supply of a butter factory a cheese factory could be operated with success. It appears to require about 400 cows to produce the milk for a successful butter factory, whereas cheese can be made with profit from the milk of 200 cows.

The cheese factory can usually afford to pay more for the milk than can the butter factory; and for the last year cheese making has been more profitable for the dairy farmer in the North Central States than has the manufacture of butter.

The success of the Wisconsin cheese factories has been largely due to the fine quality of cheese made, which finds a ready market in the West and South. The demand for cheese, as for butter, depends chiefly upon the quality. Quality should be the watchword of every farmer who produces the milk, as well as of the manufacturer of the cheese.

Another important element in the outlook for the cheese industry is the evidently increasing appreciation of the food value of cheese. Americans have been slow to learn that cheese is one of the most economical, wholesome, and digestible of our concentrated foodstuffs.

IV. THE SOUTH.

By B. H. Rawl,

Expert in Dairying, in Charge of Southern Dairy Investigations.

REVIEW OF THE INDUSTRY, BY STATES.

A survey of dairy conditions in the South, extending during the last year to 103 towns in 10 States, affords the material for this sketch.

South Carolina.—In South Carolina the dairy industry is, on the whole, developed to a very limited extent, although the northern section of the State is especially suited to this industry. The dairies of this section are, in the main, using very inferior stock, their buildings and equipment are frequently very inadequate, and they have no system of marketing their product. In several places, however, the dairies were found to be profitable, the animals in good health, and such dairy farms are distinguished from others of the community by their generally improved condition. With but two exceptions, none of the dairy farmers were using silage, and only a few of them are feeding liberally enough on green feed. That part of the State, with its especially fine climate, good lands, and abundance of

cool water, will, with a proper development, eventually become a dairy section. The southern portion of South Carolina is usually low and in many parts very productive. Forage crops can be grown in great variety and cheaply, but the dairymen are for the most part confined to the towns and cities and rely principally upon commercial foodstuffs. The cows are, as a rule, inferior to those in the northern part of the State and, while there is an abundant water supply, frequently artesian, the temperature is on an average much higher than in the northern portion of the State. The principal menace to the industry in the southern part of this State may be said to be the existence of the cattle tick.

Georgia.—In Georgia the conditions vary from the mountainous counties of the northern part of the State to the flat, level counties of the coast. In the northern counties there is an abundance of land that is not utilized, with natural pastures, an abundance of cool water, having in many cases a temperature of 54° or 55° F. This section is above the Texas fever quarantine line, the climate is good, and it is well suited to the production of butter and cheese. In the southern part of the State there is very little dairying, except for the purpose of supplying milk to the cities. Silage is not generally in use, and the city dairymen as a rule rely largely on cotton-seed meal and hulls for feeding; yet they are often prosperous.

Florida.—In Florida little attention is given to dairying, and the dairies in the vicinity of the places visited—Lake City and Jacksonville—are engaged in supplying to the towns milk at a high price and of a rather inferior quality. Inferior scrub cattle are generally in use, and no special provision is made for economical production of forage crops for feeding. Owing to the attention which is usually given to the production of fruit and vegetables, and to the large amount of swamp lands, the outlook for dairying is limited, to say the least.

Alabama.—The northern portion of Alabama is very similar to the northern portion of Georgia, being mountainous, well supplied with an abundance of cool water, thickly populated, and having numerous towns and a great variety of industries. Dairy products command a very high price and the conditions are excellent for dairying. In the vicinity of Birmingham one dairyman visited by the writer found his dairy very profitable; in the same vicinity, however, under exactly the same conditions, others were found to be very unprofitable. With one exception, no silos were found in use in that section of the State, and the buildings and stock were inferior. In the southern portion of the State, as is the case in the southern portion of Georgia, the milk production is confined principally to supplying the cities. There are a few dairymen in middle Alabama

that are making good profits, and have been in the business for a number of years, but, on the whole, the dairy industry of this section is uncertain. Feed can be raised very cheaply, however, and dairying should be made profitable.

LOUISIANA.—In Louisiana the principal interest in dairying is found in the vicinity of New Orleans, the greater portion of the State being devoted largely to the production of cotton, corn, sugar cane, and rice. In the small towns near New Orleans, however, a considerable dairy industry is found. The cattle in that section usually run on the coast, where a variety of grazing is found almost the entire year. New Orleans offers a practically unlimited demand for dairy products. The cattle used are frequently very inferior, and while, especially at Hammond, the dairy industry is much more advanced than it is in any other place in the coast section, many improvements are needed. The dairymen need silos, they need to improve their herds, they need to produce more feed on their farms, and to abandon the excessive use of cotton-seed hulls. Several successful dairies in this vicinity indicate that, in spite of the disadvantages, the possibilities for the skillful dairyman in this section are encouraging.

MISSISSIPPI.—In Mississippi the pine lands of the southern part show little agricultural development. In recent years the removal of the timber from the lands has left what are known as the stump lands, which are very cheap. The soil is light and rather sandy, but productive when improved; and the development of a dairy industry in that section which is near New Orleans would be profitable. Fertilizers are needed, which dairying would supply. In the central part of the State there are few dairymen of the better class, although there is a large production of hay, this section being favorable to the production of all kinds of forage crops. In the northern part of the State, in the vicinity of Memphis, Tenn., there are a number of dairies shipping milk to that city. The conditions there are somewhat similar to the conditions in the vicinity of New Orleans, except that the country is probably not quite so low. Some dairymen are making money, but many of them are not. There are very few silos in use, and the dairy buildings are usually inferior. The conditions in the State of Mississippi warrant the development of a good dairy industry.

TEXAS.—In Texas there is a small creamery industry in some sections. In many cases, however, the promoters of the creameries seem to have misled the farmers, who, having been disappointed in their venture, are not now very optimistic about the dairy industry. The conditions that exist in Texas are very similar to those of Mississippi, and the dairy industry at present is in its infancy. There are some excellent herds of pure-bred dairy cattle near Marshall, San Antonio, Dallas, Fort Worth, El Paso, Houston, and other towns,

from which the equipment and practice of the dairy farms in these localities are gradually being improved. The opportunities for dairying in Texas are almost unlimited.

Arkansas.—In Arkansas many different conditions exist. In the northern part of the State magnificent pastures are seen and an abundance of cool water, with an excellent climate for all seasons; but there is very little dairying there, notwithstanding these favorable conditions. In the southern part of the State we find level lands but a more limited supply of water, and much attention is given to the production of sugar cane. Between Little Rock and Memphis, however, there are a number of small towns that produce a considerable amount of milk and cream. The section of Arkansas, however, that offers the best opportunities for the dairy industry is the northern portion of the State, and there are few sections where better natural advantages may be had.

Tennessee.—Tennessee may probably be called the dairy State of the South. It is above the cotton belt, and also above the Texas fever quarantine line. Mountainous conditions prevail in the eastern part of the State, and here the dairy industry is well developed in the valleys. In the Sweetwater Valley are found in use many silos, and many good herds, including some pure-bred stock of a high class. The central part of the State, with its natural bluegrass pastures and supply of pure water, is already the home of many herds of pure-bred dairy cattle, and produces market milk and butter of the highest grades. There is no State in the South in which the dairy industry is as highly developed as in Tennessee, and the outlook here is very favorable.

North Carolina.—In the western portion of North Carolina the conditions are very similar to those of eastern Tennessee, although on the whole the dairy industry is not as well developed as in Tennessee, and in many cases very inferior dairies are found, both in equipment and methods and in the kind of stock kept. In the eastern section of North Carolina the conditions are more like those in the coast sections of South Carolina and Georgia.

THE SOUTH AS A WHOLE.

In reference to the conditions that exist in the South as a whole, attention should be called to the following facts: In some cases herds are found producing as good results as are ordinarily made in any section of America. At other places dairy products are made as cheaply as in any of the dairy sections. Altogether there is an enormous demand in the South for dairy products; almost all of the butter and cheese is imported, some cream is shipped in from States a great distance away, and a great deal of condensed milk is

used as a substitute for milk because of the scarcity and the poor quality of the fresh milk put on the market. Silage is used to a very limited extent, but in a number of the different sections, on the coast of Florida especially, the silage is of good quality. Probably the greatest reduction in profits is usually caused by the use of inferior cattle, which are found in a large majority of the dairies throughout the entire South.

On the cotton farm cotton is usually the all-absorbing crop, and little attention is given to feed crops. In many cases no more animals are kept upon the farm than are actually necessary to cultivate the cotton crop, and often there is not enough feed raised to supply even these. This system is of course exactly the reverse of dairy farming, in which the feed crops are converted into more easily marketable and more profitable products, and practically all the fertilizing ingredients of the feed (the manure) are returned to the soil, which continues to increase in productiveness.

The labor is often irresponsible and this discourages many from going into dairying, even though they appreciate its advantages. The warm summers and the disorganized condition of the dairy markets have also been discouraging. However, with the use of artificial ice, which is cheap, improved transportation facilities, and the mild winters, the thinking man is about convinced that the seasons are not unfavorable to the dairy industry.

The demand for dairy products in the South has become enormous, and inasmuch as the markets have not usually been supplied with fresh products, the trade does not demand absolutely first-class articles, although the prices are comparatively very high.

With the highly improved southern farms, the question of cheap feed is settled, for there is probably no section of America that can produce cheaper feed. Especially is the great variety of legumes that thrive in the South worthy of notice, and these crops, with cottonseed meal, settle the question of protein.

While very little attention has been given to the development of the southern pastures, it is demonstrated on farms throughout the South that an unexcelled pasture can be maintained for at least eight months in the year.

The old southern plantation with its haphazard system is being gradually transformed into a well-organized and diversified farm, and in the transformation dairying promises to be one of the most potent factors. It will occupy a portion of the cotton farms, and even if it is conducted in such a way that the dairy itself is not profitable, it will make the farm fertile and therefore profitable in other lines.

While the southern dairyman therefore will have some difficulties that are not found in the northern sections of the country, he also has many advantages over the northern dairyman in the milder climate,

cheaper cost of buildings, the greater variety of forage crops, and good markets. The South will always be a great cotton country, but it will some day be also a great dairy country.

V. THE PACIFIC COAST.

By E. A. McDonald,

Dairy Inspector, Bureau of Animal Industry.

NATURAL ADVANTAGES FOR DAIRYING.

No section of the United States offers greater returns to the intelligent dairyman than the States on the Pacific coast. Owing to the numerous streams which have their origin in the snow-clad peaks of the Coast Range, the Cascade Range, and the Sierra Nevada Range, there is a never-failing supply of fresh, pure water. In this equable climate young stock and beef cattle can run out the year round, while dairy cows require to be stabled only from two to four months, according to the locality. The soil on the western slope of the Coast Range includes extensive alluvial deposits, and that on the east side is composed largely of volcanic ash. Owing to the productiveness of these soils, it is stated that twice as many cows can be fed on these lands as can be fed on the same amount of land in the East. These advantages have not been fully appreciated. The early pioneers made their money so easily, growing from 40 to 50 bushels of wheat to the acre and from 80 to 120 bushels of oats, that they did not give thought to the fact that their land would some day become impoverished. The time has come when these farmers must recognize the value of diversified farming. During the last five years there has been a strong movement toward more intensive farming and a system of crop rotation which will restore and preserve the fertility of the soil. The dairy cow has been called upon to perform a leading part in this work, as she has in other parts of the country.

EXTENT OF THE DAIRY INDUSTRY.

The following table shows the manufacture of creamery butter and factory cheese in the years 1897 and 1904 on the Pacific coast. Returns of farm-made products are not complete.

Manufacture of creamery butter and factory cheese on the Pacific coast, 1897 and 1904.

State.	Butter.		Cheese.	
	1897.	1904.	1897.	1904.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Washington	2,094,457	7,722,911	709,364	927,083
Oregon	2,565,006	5,086,596	500,006	2,255,592
California	10,866,042	26,837,388	6,394,625	3,603,351
Total	15,526,205	39,646,895	7,608,989	6,776,026

The grade of cows on the coast has been very greatly improved during the last ten years. Many of the prominent dairymen have been securing pedigreed pure-bred stock; others are simply using pure-bred bulls to head their herds and breeding up from their best grade cows, so that the average herd shows good dairy characteristics. Here and there are found pure-bred herds of Jerseys, Holsteins, and Guernseys, and there are a few Ayrshires. The yield per cow has been gradually increasing. Many farmers weigh and test the milk of each cow, and in this way discover the profitable cows, so that there is a general weeding out of the poorest cows of the herd. In every valley on the coast may be found mixed herds, which have been bred up in this manner, and which are now large producers.

MOVEMENTS OF DAIRY PRODUCTS.

Butter and cheese manufactured in Washington is mostly consumed in the home markets, a small amount being shipped to Alaska. Butter and cheese manufactured in Oregon is only partly consumed in the home markets, the surplus dairy products being shipped to San Francisco and to the cities on Puget Sound. California, after supplying her own markets, ships her surplus to Alaska and foreign ports, and, during the first three months of the year, California is shipping more and more each year to the Eastern States. Washington is the only State on the coast which still handles a large amount of eastern butter. One reason for the demand for eastern products in Washington is her trade with Alaska. Being nearest to Alaska and having more regular means of transportation, she naturally secures a large percentage of that trade.

The possibility of increasing our trade with foreign countries depends on our ability to produce as cheaply and to deliver the product in as good condition as do other countries. When the coast States have a surplus, South American countries and the Orient seem to be the natural outlet. There is a large demand throughout the Orient for tinned butter and condensed milk and cream and for cheese. The markets at present are largely supplied by Australia, Holland, Germany, and France, with a few shipments from Sweden. Price does not seem to be so important a factor as quality, and especially uniformity. San Francisco has been making an effort to secure this trade with fair success, using a vacuum 1-pound tin. A Portland firm has also shipped some tinned butter to the Orient with varying success.

DAIRYING IN WASHINGTON.

The State of Washington may be divided into four sections, differing from each other in rainfall, temperature, and agricultural products.

The first division is the west side, or the section west of the Cascade

Mountains, for the most part heavily timbered and characterized by a rainfall varying in different parts from 30 to over 100 inches, according to direction and distance from the mountain ranges. As in all other parts of the Pacific slope, by far the largest part of the rainfall is confined to the winter months, the summer months being comparatively free from rain. This section includes the fertile valleys along the numerous rivers and creeks, the tide lands, and the fresh and salt water deltas. The soil is rich in alluvial deposits. The climate is ideal for the dairy industry. The water supply consists of beautiful streams from the mountain sides which flow through these valleys. On account of the mild winters and proximity to the market centers, the west side is eminently adapted to dairying.

The upland prairies of eastern Washington constitute the second section of the State. These prairies lie east of the Columbia River, extending to the mountains of Idaho and from the Blue Mountains on the south to the mountains of Stevens and Okanogan counties on the north. The Palouse and Big Bend prairies, which have a world-wide reputation for their immense yields of wheat, are included in this section. Except where land is far removed from the mountains dairying is profitable. The rainfall is sufficient, as the soil is a retentive clay loam. Since the coming of the hand separator there has been a gradual increase in dairy products. There is a tendency to diversified farming, making dairying an adjunct to the growing of wheat.

The third section includes the Walla Walla, Yakima, and Wenatchee valleys of central and southern Washington. These lands are all in the drier parts of the State, and their low altitude gives them warmer summers than are found elsewhere in the State. These are largely sagebrush lands, and when irrigated are very productive. This is a great fruit and dairy section. Alfalfa is the principal forage crop, and yields under proper cultivation from 5 to 7 tons to the acre, making this section particularly adapted to the dairy industry.

The farming areas of the fourth section are scattered widely. They are situated east of the Cascade Range, and are at a higher altitude than the land in the third section. The Kittitas, Colville, and Kalispel valleys are included in this section. Timothy, clover, root crops, and all the cereals are grown. The tendency of the farmers in this section is to diversified farming, with dairying as the leading branch. The Kittitas Valley will lead all the others in the amount of butter produced.

The valleys of the State are so productive that, everything else being equal, butter and cheese can be produced at a less cost here

than in the Middle West or the Eastern States. Rich, succulent food, pure water, and a temperate climate are the essentials in the manufacture of a "nutty," high-flavored, sweet butter. Nature has been lavish in her gifts to the State of Washington in this respect, and we may look forward to this State becoming a large producer of butter. There is also every reason to believe that the State will become noted for a high grade of butter which will command the highest price. Owing to the diversified industries of the State—consisting of fish, lumber, coal, and other minerals, the development of which will employ a large number of men—the rapid growth of her cities, the development of Alaska, and the growth of trade with the Orient, South America, and the islands of the Pacific, the State can always count on the demand for dairy products being greater than the supply.

DAIRYING IN OREGON.

The State of Oregon is in the same latitude as South Dakota and the New England States, but the Japan Current equalizes the temperature and gives Oregon an ideal climate. All kinds of forage crops are grown without irrigation, except in a very small area in southeastern Oregon. The State has five natural dairy divisions.

The coast section lies between the Coast Range and the Pacific Ocean. The northern part of this section has become famous for its salmon. The annual value of the salmon industry is approximately $3,000,000. The profits in this industry have been so large that very little attention has been given to dairying, which is still in its infancy. Tillamook County is the great cheese section of the Pacific coast. It is an ideal dairy section. Six different streams traverse this county, taking their rise in the Coast Range and emptying into the Pacific Ocean, so that this valley has an abundance of pure fresh water.

The Willamette Valley includes the counties on either side of the Willamette River, lying between the Cascade and Coast Range of mountains, a distance of about 100 miles. If the natural resources of this valley had been properly utilized they would have made it a greater butter producer than any other section on the Pacific coast; but the soil became so impoverished by continuous cropping with wheat that where 40 bushels were once produced 13 bushels per acre is now an average crop. How shall we redeem the land? There is but one reply: By the use of the dairy cow. This valley can be made to produce butter to supply ten times the population of the State. New blood, dairy literature, and farmers' institutes are the leaven which is changing the "mossback" into an intelligent dairyman. Here and there may be seen pure-bred herds of Jerseys, Holstein-Friesians, and Ayrshires.

Southwestern Oregon has the most desirable climate in the State, having neither excessive rainfall nor excessive heat. Two beautiful rivers—the Umpqua and Rogue—and their tributaries traverse this section, which has already become famous for its apples. On the higher lands the dairy industry will flourish, and alfalfa will be the principal forage crop. The manufacture of butter has been increasing very rapidly. Almost every farmer has the foundation for a dairy herd. Creameries with modern equipments are in operation in several places.

Northeastern Oregon constitutes the fourth section. Wheat and beef cattle are the principal agricultural products, and dairying is still to be introduced.

The fifth section is the undeveloped part of Oregon. It lies to the southeast. One can travel through this section only by stage or private conveyance. Here are thousands of acres of rich, alluvial loam and volcanic ash, capable of being irrigated. It is certain that this section, which a few years ago grew only sagebrush and whose principal inhabitants were the jack rabbit and the coyote, is destined to become the home of thousands of prosperous dairymen.

Portland, the metropolis of Oregon, located near the confluence of two great rivers—the Columbia and the Willamette—is the only city of any commercial importance in the State. This city must find ways and means of disposing of the vast resources of Oregon and of providing the implements of production for the development of this great State.

DAIRYING IN CALIFORNIA.

California has a soil and climate so varied that all fruits, both deciduous and citrus, can be grown to perfection. All kinds of cereals are grown with success. California has also great possibilities as a dairy State.

The counties surrounding the bay of San Francisco comprise the best developed dairy district of California. It is from these counties that California is receiving one-third of its butter and San Francisco all of its milk. The production of butter in these counties is already up to the limit, as the city of San Francisco and the contiguous cities draw their milk supply from these counties, so that California will have to look to some other section of the State for her future supply of butter.

The second section is an ideal section for the production of milk and for converting it into butter and cheese. This section includes all the counties north of the bay counties to the Oregon line, between the Coast Range and the Pacific Ocean. The soil is very rich and almost all of it is productive. The natural grasses are

clover and rye grass. The size of the average herd of dairy cows is 20, and the produce averages about 200 pounds of butter per cow. This section has been the greatest butter producer in California, but the production has apparently reached the limit.

In the third section, including the counties south of the bay counties, extending along the coast to the Mexican line, we find varied conditions. With irrigation and proper management the section about San Luis Obispo should become a large butter producer, as it is better adapted to the dairy industry than to any other branch of agriculture. The butter from this valley is shipped to Los Angeles and San Francisco. Los Angeles County is credited with the manufacture of over 2,000,000 pounds of butter per year, which would indicate that this county is especially adapted to the dairy industry. This, however, is not the case, for, while there are some good dairy herds in this country, a large proportion of the cream comes from outside the county. The country along the coast from Los Angeles to San Diego enjoys an equable climate well suited to fruit growing with irrigation, but the small rainfall will always hinder this section from becoming great in dairying. The hope of southern California is in what is known as the Imperial Valley. This valley contains 500,000 acres of very rich land, which is being irrigated from the Colorado River. When irrigated, this land will grow large crops of alfalfa. There are two drawbacks to this section, the heat and the flies. Dairying will undoubtedly be carried on to a considerable extent, but the difficulty of securing labor will be a serious disadvantage. This valley will probably become a great live-stock section.

The fourth section includes the San Joaquin Valley. To this section and the Sacramento Valley, California must look for the great increase in dairy products. A large portion of the San Joaquin Valley is irrigated by means of artesian and pumping wells, assisted by irrigation ditches which draw their supply from the rivers near their sources in the Sierra Range. The conditions of soil and climate are ideal for the growth of alfalfa. Grass starts with the first fall of rain and continues through the winter, so that there is green grass throughout the year. Near Stockton is one of the largest and best of pure-bred dairy herds. Nature has provided all the conditions for an ideal home for dairy cattle and the owners are utilizing these conditions in the most practical manner. The barns are strictly modern, well ventilated, and with every convenience for the comfort of the cows.

We now pass to the fifth section, the Sacramento Valley. This entire section has been noted for its immense yields of wheat and barley, but continuous cropping with wheat has impoverished the soil

so that where 30 bushels were once grown now from 8 to 10 bushels is all the land will produce. The dairy cow will be called upon to reclaim these impoverished lands, with the aid of irrigation, and they will be made to blossom with the alfalfa flower. The surface of this wonderful valley has only been scratched. One can not estimate the possibilities of the increase in the dairy industry. The scarcity of labor is a great hindrance to the development of this valley. If California could secure labor at a reasonable wage, the State could easily triple its production.

CONCLUSION.

Sufficient data have been given to show that the Pacific coast States will become large producers of dairy products. Owing to the unparalleled growth of the cities and the varied industries, it may be that the supply will not increase more rapidly than the demand, but a reasonable conclusion to be drawn is that there will be a surplus within a few years. The markets of China and Japan, the countries of South America, and the islands of the Pacific Ocean are the natural outlets, and everything should be done to secure these markets for the dairymen of the Pacific coast.

LIME-SULPHUR WASHES FOR THE SAN JOSE SCALE.

By A. L. Quaintance,

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ORIGIN AND EARLY USE.

The lime-sulphur-salt or so-called California wash has been for many years the principal treatment for the San Jose scale (*Aspidiotus perniciosus* Comst.) in orchards in California and elsewhere on the Pacific slope, and within the last five or six years it has become practically the standard treatment for this insect in the East. Originally developed as a dip for the control of scab on sheep, it was first used as an insecticide on fruit trees, according to Quayle,[a] in 1886 by a Mr. F. Dusey, of Fresno, Cal., who experimented with a sheep dip prepared by Mr. A. T. Covell. The wash proved very efficient, and with modifications came quickly into favor. Lime-sulphur preparations, either dry or in the form of washes, have long been more or less used by orchardists in the control of insects and fungi, but these preparations are not comparable to the boiled lime-sulphur-salt wash, and practically the usefulness of the latter as a scalecide was an independent discovery. Since first used on fruit trees the wash has been variously modified in formula, and it has been shown to have a considerable range of usefulness, both as an insecticide and as a fungicide.

HISTORY OF USE IN THE EAST.

Upon the discovery of the San Jose scale in eastern nurseries and orchards, attention was naturally drawn to the treatments which had been found so effective on the Pacific coast. In the fall of 1894 Messrs. C. L. Marlatt and D. W. Coquillett,[b] of the Bureau of Entomology, carried out an extensive test of washes in a scale-infested orchard in Maryland, among which were the lime-sulphur-salt wash, as used in California, and the Oregon wash, both being used at ordinary strength and at double strength. Examination of the treated trees about a month after applications had been made indicated that these washes had been fatal to only a very small percentage of the scales, and these conditions had not changed by late April of the following

[a] Bul. 166, Cal. Agr. Exp. Sta. (1905).

[b] Bul. 3, n. s., Div. Ent., U. S. Dept. Agr., pp. 56, 71 (1896).

spring, when further observations were prevented by the application of a soap treatment to the orchard under experiment, and there was thus no opportunity to observe the later action of the wash. The negative results from these tests, attributed to the heavy rainfall in the East as compared with the drier climate of California, discouraged further experiment on the part of entomologists, and no further tests in the East appear to have been made until the spring of 1900, when the lime-sulphur-salt wash was again tested by Mr. Marlatt,[a] he having in the meantime assured himself by personal investigation of its effectiveness in California, a matter which his earlier experiments had somewhat led him to doubt. These experiments in 1900, by the Bureau of Entomology, gave excellent results, attributed in part by Mr. Marlatt to the favorable weather conditions following applications, and really marked the beginning of the series of extensive experiments with this wash by various State and experiment station entomologists and others in the East.

During the fall of 1901 the wash was adopted by Dr. S. A. Forbes[b] in his scale control work in Illinois, as a result of an investigation of its effectiveness in California and Oregon, in which latter State the rainfall is quite as heavy as in the East. Definite experiments were planned by Doctor Forbes in the spring of 1902, and carried out by Mr. E. S. G. Titus, at that time his assistant. Also, in the fall of 1901 experiments with the wash were inaugurated by Prof. F. M. Webster in Ohio[c] when entomologist of the Ohio agricultural experiment station, and carried out by Messrs. A. F. Burgess and Wilmon Newell. In the spring of 1902 experiments were begun in Connecticut by Dr. W. E. Britton,[d] in Georgia by Mr. W. M. Scott,[e] by the writer[f] in Maryland, and possibly by others. The general results of these tests, made in widely separated localities and under different climatic conditions, pointed strongly to the probable effectiveness of this wash in destroying the scale even in a climate of heavy rainfall, as in the East. During the year or so following the entomologists of many of the Eastern States, confronted with the scale problem, began experiments with the wash under their respective conditions, and the favorable results from these and previous tests led to its speedy adoption by many orchardists in preference to the mineral oils and soap washes previously largely used. Its adoption was the more rapid for the reason that the mineral oils, on the whole, had proved unsatisfactory on account of frequent injury to the trees.

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[a] Annual Report of the Entomologist, Annual Reports, U. S. Dept. Agr., p. 31 (1900); Bul. 30, n. s., Div. Ent., U. S. Dept. Agr., p. 34 (1901).

[b] Bul. 71, Ill. Agr. Exp. Station (1902).

[c] Bul. 37, n. s., Div. Ent., U. S. Dept. Agr., p. 33 (1902).

[d] Bul. 40, n. s., Div. Ent., U. S. Dept. Agr., p. 38.

[e] Bul. 37, n. s., Div. Ent., U. S. Dept. Agr., p. 48 (1902).

[f] Bul. 37, n. s., Div. Ent., U. S. Dept. Agr., p. 37, and Bul. 40, p. 36.

It is of interest in this connection to note that, following the recommendations of an agricultural journal, the wash had been used in the control of the scale in the spring of 1901 by Mr. N. P. Creeley,[a] of Burlington, N. J., who successfully treated a 14-acre peach orchard; by Mr. C. E. Hathaway,[b] of Somerset, Mass.; and by Mr. S. S. Stouffer, of Sharpsburg, Md., who treated several thousand peach and apple trees, and had constructed an excellent steam cooking plant. An examination of this last orchard by the writer during the summer of 1901 proved to him that most satisfactory results had been obtained.

At the present time the general effectiveness of the wash, when properly made and applied, in controlling the scale under eastern conditions may be considered as established. It is especially satisfactory on the peach, plum, and pear, and mainly so on the apple, although some orchardists have not secured satisfactory results in controlling the scale on apple. It is held by some that the dense pubescence which more or less covers the terminals of apple twigs of many varieties prevents the thorough treatment of these parts, with the result that the "lice" from females which have thus escaped treatment are forced to migrate to the young fruit, where they settle and breed, so that at picking time apples from sprayed trees are often badly marked with the scale. The unsatisfactory results which have at times been reported as following the treatment of large trees, owing especially to infestation of the fruit, are due partly to the conditions above mentioned, but more especially to lack of thorough applications, as such work offers serious practical difficulties.

INGREDIENTS OF THE WASH.

As the name indicates, the wash is made of lime, sulphur, and salt with water; the salt, however, is often omitted. These are boiled together for a sufficient length of time, during which boiling chemical action between the lime and sulphur takes place, producing in solution the insecticidal properties of the wash.

LIME.

As generally understood, the word "lime" refers to burned or quicklime, known chemically as calcium oxid (CaO), and it is this form that is used in the preparation of the wash. The limestone, or carbonate of lime, from which lime is obtained varies greatly in purity, thus affecting the purity of the resulting quicklime, which in addition may be more or less contaminated with the ashes from the fuel used in burning it. An important impurity of limestone is magnesia (MgO), existing as magnesium carbonate, and replacing the lime (CaO)

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[a] Farm Journal, Vol. XXVI, p. 24 (1902).

[b] Farm Journal, Vol. XXVI, p. 63 (1902).

up to 21.7 per cent, when the rock is said to be a dolomite. Magnesian and dolomitic limestones are those in which magnesia occurs in smaller proportions than just indicated. Mechanically mixed with limestone may be varying amounts of impurities, such as sand, clayey and carbonaceous matter, oxids of iron, etc., giving rise to different kinds of limestone, depending upon the proportion of the respective substances present.

In the following table are given analyses of several samples of lime, all from the State of Maryland, indicating the variations in the composition of lime to be found in a single State, though it should be remembered that Maryland is unusually rich in limestone:

Analyses of lime (CaO) from Maryland limestones.[a]

[Prof. H. J. Patterson and Dr. H. B. McDonell, analysts.]

Maryland laboratory No.	Description of sample.	Insoluble matter.	Iron and aluminum oxids.	Lime (CaO).	Magnesia (MgO).	Undetermined.[b]	Total.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1043	Woodsboro lime	1.85	3.10	91.10	0.92	3.03	100.00
1044	Cavetown lime	2.75	4.83	73.90	17.94	.58	100.00
1732	Wrightsville lime	.15	1.50	67.44	30.91	....	100.00
1790	Groves lime	25.00	2.40	47.10	25.16	.34	100.00
	Howard County lime	6.02	13.30	75.40	2.00	3.28	100.00
7	Oyster shell lime, fresh burned	5.79	2.71	84.58	.55	5.92	100.49

[a] Bul. 61, Md. Agr. Exp. Sta.

[b] Mostly water and carbonic acid gas.

According to composition, limes have been classified by Gillmore as:

(1) Good or fat limes, containing as a rule less than 10 per cent of impurities.

(2) Poor or meager limes, containing from 10 to 25 per cent of sand or other impurities.

(3) Hydraulic limes, with from 30 to 35 per cent of various impurities.

(4) Hydraulic cements.

The so-called fat limes slake readily with water, forming a creamy mixture, whereas the poor or meager limes, containing considerable magnesia, slake more slowly, forming a poor mixture. Hydraulic limes and cements need not be here considered. In the preparation of lime-sulphur washes the fat limes containing less than 10 per cent of impurities should be used, giving a better wash and one more free from sand and grit, which rapidly wears out the valves of the pump and the caps on the nozzles. With formulas containing an excess of lime there is little danger of an insufficient amount, even though impure lime be used, but in a formula where equal quantities of lime and sulphur are used, in case of very impure lime the quantity of this ingredient may be insufficient to unite chemically with the sulphur.

SULPHUR.

Sulphur may be regarded as the important ingredient of the wash, as the compounds formed by its union with the lime are the active agents in destroying insects, and its insecticidal effect will be largely determined by the proportion of sulphur employed.

Sulphur occurs naturally in large quantities in the form of sulphids, as pyrites or sulphates, as gypsum, and native in volcanic regions in vast beds, more or less mixed with gypsum and various earthy materials. The sulphur is separated from the ore or its impurities by a process of fusion, and the melted sulphur thus secured, which is caught in molds, is the ordinary brimstone of commerce. Brimstone is not sufficiently pure for all purposes, and is refined by sublimation, which consists in heating the brimstone in suitable retorts until it vaporizes. The sulphur vapor passes into a condensing chamber, and that which first comes over is condensed by coming in contact with the cold walls of the chamber and deposited in a minutely divided condition. This deposit is scraped from the walls of the chamber before the latter become hot, and constitutes the so-called flowers of sulphur. After a few days' continuous use the condensing chamber becomes sufficiently hot to cause sulphur to fuse or melt and run to the bottom of the condenser, where it is collected and run into molds, producing stick, or roll, sulphur. This, when finely ground, is designated flour sulphur, two grades being commonly found on the market, light and heavy flour, depending on the grinding and bolting processes. In the process of subliming, the impurities in the brimstone do not pass over into the condensing chamber, and the flour and flowers of sulphur are equally pure, differing practically only in fineness, though the latter may be somewhat more acid. Either the flour or flowers of sulphur may be used in the preparation of lime-sulphur washes, and in the writer's experience they are equally satisfactory. There appears to be no basis in fact for the preference of some orchardists for flowers of sulphur as against flour sulphur, and as the latter is somewhat cheaper it should be preferred.

Ground brimstone has been utilized to a limited extent in lime-sulphur washes, but exact data are lacking as to its suitability for this purpose. When comparatively free from impurities and finely ground and bolted, as in the preparation of flour sulphur, it would appear to be quite as suitable as the latter, and by its use the cost of the wash could be considerably lessened.

The so-called "crystalline" sulphur that has recently come into limited use in some parts of the South is brimstone obtained directly from the mines, being melted in the earth by means of superheated water and then pumped out into bins, where it is allowed to cool.

It is put on the market in lumps just as it breaks under the pick, and in this condition it is much too coarse for use in making lime-sulphur washes, since even after prolonged boiling much free sulphur remains in the residue and is wasted.

SALT.

Common salt, or sodium chlorid (NaCl), has been considered a necessary ingredient of the wash, its function, however, not being definitely ascertained. It was a constituent of the wash when used as a sheep dip, and its usefulness seems not to have been questioned for some years. Pierce,[a] as a result of careful tests in California, was not able to detect any advantage from its use in washes against peachleaf-curl and recommended its omission. Recent experiments in various eastern States, representing a considerable range of latitude, with washes made with and without salt, support the conclusion that its use is not at all essential. Numerous entomologists recommend its omission, while others leave its use optional. Chemical studies of washes made with and without salt show that its presence does not affect the chemical nature of the wash. It has been claimed that the use of salt, by raising the specific gravity of the wash, raises its boiling-point, insuring a better union of the lime and sulphur; also that it causes the wash to adhere to the trees better, and that it renders the precipitate more flocculent, so that it remains in suspension longer. The penetrating power and causticity of the wash may also be increased by the salt, it being a matter of common remark among sprayers that a wash in which salt is used is noticeably more caustic to the face and hands than one from which it has been omitted. Notwithstanding these supposed advantages from the use of salt, the actual tests in the majority of cases have shown that it is not possible to distinguish between the insecticidal effect of washes made with and those made without salt. Its use is, therefore, not considered necessary.

VARIATIONS IN FORMULAS.

The original sheep-dip formula, namely, lime 80 pounds, sulphur 100 pounds, salt 10 pounds, sugar 20 pounds, and water 160 gallons, first used on fruit trees, has been variously modified, often on mistaken conceptions as to the insecticidal properties of the several constituents. Some believed that lime was the active ingredient, and that the others were necessary to get the lime into solution. Until recently the necessity for the salt appears not to have been questioned, and practically nothing was known of the chemistry of the wash until the studies

[a] Bul. 20, Div. Veg. Phys. and Pathol., U. S. Dept. Agr., p. 155 (1900).

of Mr. J. K. Haywood,[a] of this Department, in 1900 and subsequently, and of Prof. R. W. Thatcher,[b] begun in 1903. Definite field experiments to determine the necessary quantity and proportions of ingredients were first reported by Pierce in 1900,[c] in connection with his studies of peachleaf-curl in California, and similar tests in the control of the San Jose scale under eastern conditions were begun but four or five years ago. Recently, however, a large amount of experimental work has been done and there is at present a considerable literature on the subject. Experiments have been made with washes containing the usual ingredients in varying proportions; with various methods of preparation; with self-boiled washes, etc. In general it has been shown that all of the stronger well-boiled washes are about equally effective in killing the scale, and it has been difficult to decide upon one as against another. Numerous formulas have thus come to be recommended, which, while undoubtedly effective in killing the scale, differ more or less in the proportion of ingredients and mode of preparation, and this has had a tendency to confuse prospective users and has not always been conducive to economy. With an insecticide and fungicide coming so generally into use, it would appear highly desirable, if practicable, that a standard formula and method of preparation be adopted, based on greatest economy consistent with effectiveness. Present recommendations of a number of State and station entomologists and of the Bureau of Entomology are given in the table on page 437, calculated on a uniform basis of 100 gallons of wash.

The quantity of lime per 100 gallons of wash is seen to vary from 25 to 80 pounds, ranging, in the majority of formulas, however, from 30 to 50 pounds. The variation in sulphur (the more expensive ingredient) per 100 gallons is considerably less, namely, from 25 to 40 pounds, ranging mostly between 30 and 35 pounds, which quantity is sufficient to insure a satisfactory wash. In numerous formulas salt has been omitted entirely or its use left optional. When recommended, the amount varies from 10 to 33⅓ pounds. The period of cooking varies from thirty minutes to two hours. There is also much diversity in details of preparation (not shown in the table) as to the treatment of ingredients, the order of placing them in the cooking vessel, and the use of hot or cold water in the final dilution.

During the last two years the Bureau of Entomology has devoted some attention to field experiments with lime-sulphur washes in order to determine an efficient and economical formula and to secure information on other questions pertaining to its practical use. As a part of this investigation an extended chemical study of lime-

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[a] Bul. 30, n. s., Div. Ent., U. S. Dept. Agr., p. 35 (1901); Jour. Am. Chem. Soc., Vol. XXVII, p. 247 (1905).

[b] Bul. 56, Wash. Agr. Exp. Sta. (1903); Bul. 76, Wash. Agr. Exp. Sta. (1906).

[c] Loc. cit.

sulphur washes has been made by Mr. J. K. Haywood, of the Bureau of Chemistry.[a] In the field experiments the same formulas were tested in three distinct latitudes, namely, in Georgia, at Fort Valley; in Maryland,[b] at Laurel, Jessups, and Patuxent; and in western New York, at Youngstown, in 1905, and at North East, Pa., in 1906. It was thought that by making tests of identical formulas in a northern, a middle, and a southern State possible differences in results due to climatic or other conditions would be more readily explained.

The experiments have included the treatment of scale-infested apple, peach, and Japan plum trees, and unless otherwise indicated applications of sprays were made shortly before growth of trees had begun in spring. Peach and plum trees treated were average 5 to 7 year trees and the largest apple trees were 8 or 9 years old. In general satisfactory results were obtained from all of the well-boiled washes containing not less than 15 pounds of sulphur to 50 gallons of water, with a slight balance in favor of the stronger washes, especially for first treatment of badly infested trees. Washes containing somewhat less than 15 pounds of sulphur to 50 gallons of water were not satisfactory in killing the scale. Some conclusions reached by these tests are:

(1) An efficient and economical formula is lime 20 pounds, sulphur 15 pounds, water to make 50 gallons, and boiled for one hour.

(2) Salt is not a necessary ingredient of the wash.

(3) The self-boiled lime-sulphur-caustic-soda wash is reasonably effective and should be used when it is not practicable to provide a cooking plant for making the boiled wash. The self-boiled lime-sulphur wash is much less efficient and is wasteful.

(4) Applications in late fall give good results, but not so good as applications in spring.

From general observations careless preparation and lack of thorough application are considered the principal causes of unsatisfactory results in the use of the lime-sulphur wash.

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[a] Bul. 101, Bureau of Chemistry. The Lime-Sulphur-Salt Wash and Its Substitutes.

[b] Experiments in Maryland in cooperation with the Maryland Agricultural Experiment Station.

Lime-sulphur-salt wash formulas recommended in various States and by the Bureau of Entomology.

	Quick-lime.	Flour or flowers of sulphur.	Salt.	Water.	Time of cooking.
	Lbs.	*Lbs.*	*Lbs.*	*Galls.*	
Alabama	42	36	10	100	35 minutes, or until of a dirty yellowish-green color.
California:					
Agricultural experiment station.	50	33⅓	16⅔	100	1 to 2 hours.
State horticultural commission.	66⅔	33⅓	25	100	2 hours, or until sulphur is thoroughly dissolved.
Connecticut:					
Storrs agricultural experiment station.	50	40	0	100	30 to 45 minutes.
Agricultural experiment station.	50	35	0	100	Three-fourths to 1 hour.
Delaware	80	40	30 or 0	100	30 minutes.
Georgia:					
State board of entomology	40	32	20 or 0	100	40 minutes to 1 hour.
Experiment station	42	36	10 or 0	....	35 to 40 minutes, or until mixture is yellowish-green color.
Illinois	30	30	0	100	1 hour.
Kentucky	50	35	25	100	35 minutes.
Maryland	40	30	20	100	1 hour.
Massachusetts	33⅓	33⅓	0	100	1¼ hours or longer.
Michigan	40	30	30	100	1 hour or more.
Missouri (agricultural experiment station).	30	30	30	100	2 hours.
Ohio:					
State department of agriculture.	33⅓	33⅓	0	100	1 hour.
Agricultural experiment station.	30 or 40	30	0	100	45 minutes at least.
Oregon	33⅓	33⅓	0	100	1 hour, or until mixture is of a deep blood-red color.
Tennessee	42	36	0	100	1 hour.
Pennsylvania	44	34	0	100	1 hour.
New York:					
Agricultural experiment station.	40	30	0	100	1 hour.
State entomologist	40	30	0	100	30 minutes at least.
New Jersey	33⅓	33⅓	33⅓	100	Boil until mixture becomes deep amber color.
North Carolina	40	34	20 or 0	100	30 minutes.
Virginia	30	30	....	100	40 minutes.
Washington	25	25	0	100	30 minutes to 1 hour.
Bureau of Entomology, U. S. Department of Agriculture.	40	30	0	100	1 hour.

CHEMICAL CONSIDERATIONS.

Considerable attention has been given to the chemistry of lime-sulphur washes, notably by J. K. Haywood,[a] of the Bureau of Chemistry of this Department, and by Prof. R. W. Thatcher,[b] of the Washington Agricultural Experiment Station. These investigations

[a] Bul. 30, n. s., Div. Ent., U. S. Dept. Agr., p. 35 (1901); Jn. Am. Chem. Soc., Vol. XXVII, p. 247; Bul. 101, Bu. Chemistry, U. S. Dept. Agr.

[b] Bul. 56, Wash. Agr. Exp. Sta. (1903); Bul. 76, Wash. Agr. Exp. Sta. (1906).

have thrown light on several important questions connected with the preparation and use of these washes, explaining results noted in practical experimentation and indicating in precise terms the conditions of its economical preparation.

EFFECT OF DIFFERENT PERIODS OF BOILING.

Analyses of washes boiled for different lengths of time show that the sulphur is not sufficiently dissolved by 15 minutes' boiling, and that 30 minutes is nearly but not quite long enough, while boiling for 45 minutes to 1 hour dissolves practically all of the sulphur present. Analyses of the self-boiled lime-sulphur wash show that only about one-twelfth of the sulphur present is dissolved, there being, therefore, a great waste of sulphur. In a properly prepared self-boiled lime-sulphur-caustic-soda wash about 80 per cent of the sulphur present is put in solution, whereas if such a wash in addition be heated for 15 or 20 minutes about 95 per cent of the sulphur is dissolved.

USE OF DIFFERENT GRADES OF SULPHUR.

Analyses of washes made with flour sulphur and flowers of sulphur show that there is no essential difference between them as to their solubility with a given period of boiling, practically all sulphur going into solution with 1 hour's boiling. In washes made with the so-called crystalline sulphur, the amount of free sulphur remaining after 1 hour's boiling varies widely, depending on the size of lumps of the sulphur employed, there being, however, in all cases quite too much waste to render its use advisable. Crystalline sulphur, when finely ground, largely goes into solution after thoroughly boiling from 1½ to 2 hours. Generally the latter period will be found preferable.

OMISSION OF SALT; EFFECT OF REHEATING.

Repeated analyses have shown that salt has no effect whatever on the chemical composition or physical character of the wash, thus confirming the conclusions as to its uselessness in practical field tests.

Reheated lime-sulphur washes do not differ chemically or physically from freshly prepared washes of ordinary strengths. A very strong wash, as, for example, one yet undiluted, upon cooling forms many crystals, which, however, dissolve upon reheating.

PREPARATION OF THE WASH.

The recommendations made at the present time for the preparation of the lime-sulphur washes vary more or less as to the handling of the ingredients preparatory to cooking, but these variations appear to be of little if any importance as affecting the character of the finally prepared wash. The satisfactory results obtained from the

use of washes prepared in various ways indicate that it is quite immaterial whether the lime be first slaked in whole or in part and the sulphur added, or the sulphur be added to the cooking vessel followed by the lime, or all ingredients be added together. Manifestly the practice least troublesome should be followed. More importance, however, must be attached to the period of cooking, concerning which recommendations are not uniform. If cooking is insufficient, free sulphur will remain in the wash uncombined with the lime and, according to present belief, will be largely wasted. If cooking is continued longer than necessary to effect a chemical combination of sulphur and lime, there is simply a waste of labor and fuel, but perhaps no other objectionable effect. The period of cooking will vary somewhat, depending upon the heat maintained and the kind of sulphur used. Practically, as chemical studies show, there will be no difference between the flour and the flowers of sulphur in regard to the time required to bring into solution. Sulphur in coarser particles, or lumps, as the so-called crystalline sulphur, will yield to boiling much more slowly; and even after prolonged cooking there may remain in the wash a considerable quantity of free sulphur. If salt is to be used in the wash, evidently it should be added early during the process of cooking, since one of its supposed functions is to increase the specific gravity of the wash, thus raising the boiling-point.

THE METHOD RECOMMENDED.

Numerous methods of preparing the wash, as followed by practical orchardists, have been investigated by the Bureau of Entomology, or tested by it in the course of its experimental work. The following formula and method of preparation have uniformly resulted in a satisfactory wash, and are quite simple:

Lime	pounds	20
Sulphur (flour or flowers)	do	15
Water to make	gallons	50

PREPARATION.—Heat in a cooking barrel or vessel about one-third of the total quantity of water required. When the water is hot add all the lime, and at once add all the sulphur, which should previously have been made into a thick paste with water. After the lime has slaked, about another third of the water should be added, preferably hot, and the cooking should be continued for an hour, when the final dilution may be made, using either hot or cold water as is most convenient. The boiling due to the slaking of the lime thoroughly mixes the ingredients at the start, but subsequent stirring is necessary if the wash is cooked by direct heat in kettles. If cooked by steam no stirring will be necessary. After the wash has been prepared it must be well strained as it is being run into the spray pump barrel, or tank.

COOKING.

The ingredients of the wash, in proper proportion, are boiled together in water, by which means chemical action between the lime and sulphur is brought about, producing in solution the insecticidal properties of the wash, the extent of chemical action depending directly upon the length of time cooking continues. From 45 minutes to an hour of vigorous boiling will put practically all of the sulphur into solution, and preference should be given to the latter period. A properly cooked wash is a heavy, caustic, orange-yellow liquid, with a strong sulphurous odor. Upon standing, the sediment settles to the bottom, leaving the liquid relatively clear. Sometimes the wash is dark green when the lime is thoroughly mixed with the liquid portion, but when the wash is allowed to settle the supernatant liquid is the usual orange-yellow. This is probably due to the presence of iron and manganese sulphids in the lime. Prolonged boiling tends to produce small quantities of other sulphur and lime compounds, but these are of practically no importance. Aside from the waste of fuel, prolonged cooking is much preferable to insufficient cooking. The residue or insoluble matter left in vessels after cooking should be frequently examined. If, with sufficient cooking, it shows up yellow, it indicates the presence of free sulphur, and more lime is needed. The presence in the residue of both lime and sulphur indicates that more boiling is needed. The kind of apparatus employed in cooking is immaterial, but it should be efficient, convenient, and economical. Scarcely any two cooking plants are alike, and there is afforded opportunity for the exercise of considerable ingenuity in their construction to best meet individual conditions.

OUTFITS FOR COOKING ON A SMALL SCALE.

For small orchards, of 50 acres or less, it may not be considered advisable by owners to fix up a steam cooking plant, but the writer believes it would be economy to do so where orchards of 25 acres or more are to be treated, especially if the trees are large ones. If but small quantities of wash are needed, as for the treatment of a small home orchard, an ordinary kettle or hog scalder will be satisfactory. It may be placed on bricks on the ground and the fire built beneath, as in the ordinary heating of water. The kettle should hold 35 to 40 gallons, and preferably more if a barrel spray pump is to be kept supplied; and it will be necessary to make final dilution of the wash in the spray-pump barrel. With some such facilities for cooking, one barrel sprayer can be kept busy most of the time.

For larger orchards, if a steam outfit is not considered advisable, large iron kettles holding from 60 to 80 gallons should be placed in a brick furnace, one or more kettles being used, according to size of orchard and the number of spray gangs which it is proposed to run.

With a battery of three or four large kettles and with proper water facilities from 150 to 200 gallons of wash may be prepared every hour. An important objection to this method of cooking is that the wash, when prepared, must be dipped from the kettles and poured into the spray barrel or tank, entailing an important loss of time; and to prevent burning, while cooking, the wash must be constantly stirred. Time and labor saving conveniences, however, may often be provided which will considerably lessen these difficulties. Thus in Plate XXXVII, figure 1, is shown a convenient single-kettle furnace. The water is forced from a spring by means of a ram into barrels slightly above the level of the kettle, to which it is supplied in pipes by gravitation. From the kettle the cooked wash is poured into a trough which delivers it directly through a strainer into the spray tank.

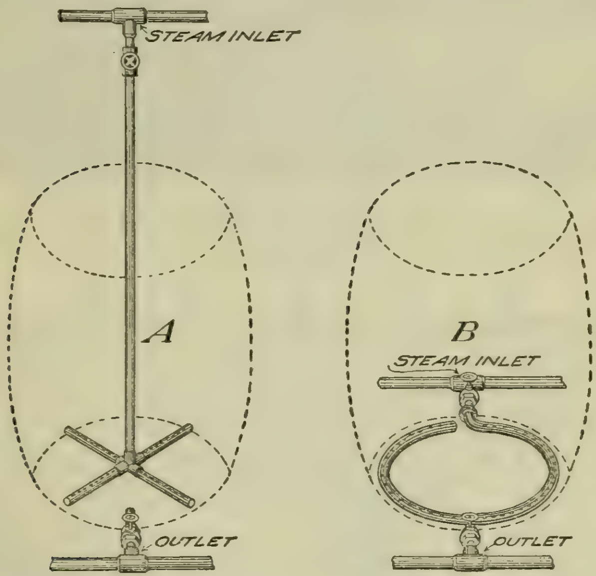

FIG. 15.—Two plans for conducting steam into barrels: *A*, pipe entering from above, and terminating in double T, with perforations in the arms; *B*, pipe entering barrel near base, and forming a circle. (From Waite.)

STEAM COOKING OUTFITS.

In most of the larger commercial orchards which are infested with San Jose scale steam plants have been provided for cooking the wash, and these vary much in detail. The steam boilers used for supplying steam vary from 3 or 4 horsepower to 12, 15, or 20 horsepower—the smaller usually of the upright type, the larger mostly horizontal and stationary, though some portable boilers are in use. Boilers of 3 or 4 horsepower, such as are used for feed-cooking purposes, are suitable when but 2 or 3 barrels of wash are to be prepared at a time, and will in addition keep 1 or 2 barrels

of water hot. A boiler of 12 or 15 horsepower will furnish sufficient steam for cooking simultaneously 8 to 10 barrels of wash, keeping hot the necessary amount of water, and operating the pump for supplying the water tank with water. In general, 1 horsepower will be required for each cooking barrel or similar vessel, but there should be allowed an excess of power amounting to 25 or 30 per cent for heating water, pumping, etc. The general arrangement of three cooking plants is shown in Plate XXXVIII. An outfit such as shown in the middle figure of Plate XXXVIII lacks much in convenience, as is at once apparent. The plant shown at figure 2 of Plate XXXVII is an especially convenient one, and might well serve as a model for persons contemplating the construction of a steam cooking plant with a capacity of 6 or 8 barrels.

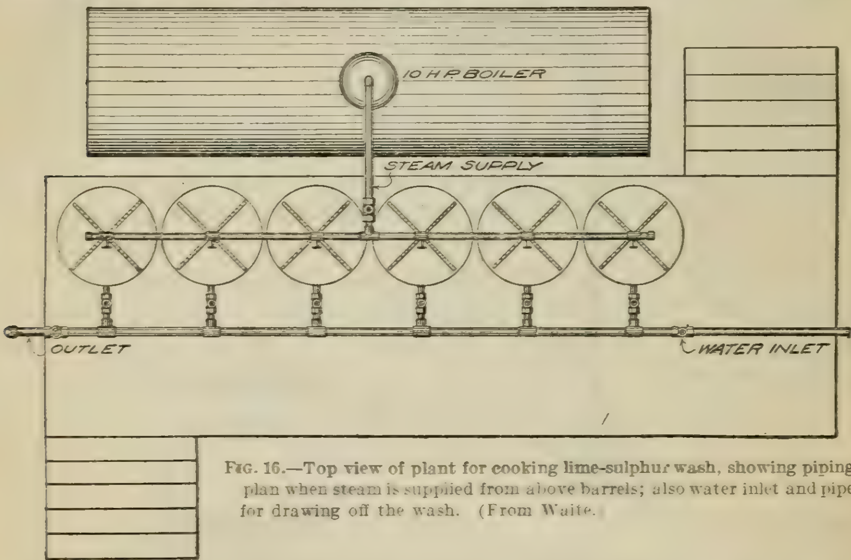

FIG. 16.—Top view of plant for cooking lime-sulphur wash, showing piping plan when steam is supplied from above barrels; also water inlet and pipe for drawing off the wash. (From Waite.)

In the construction of steam cooking plants attention should be given to the following requisites:

(1) The platform should be strong and roomy and of sufficient height to permit the wagons to be driven alongside and the spray tanks to be filled directly from the cooking vessels by gravitation.

(2) The steam boiler should be of sufficient size to allow approximately 1 horsepower for each cooking barrel or equivalent, with a 25 or 30 per cent excess of power for heating water and pumping water into the water-supply tank.

(3) The arrangement of pipes should be such that these will be as little in the way as is consistent with their use. Valves should be provided which will permit the operation of one or more cooking vessels independently of the others.

FIG. 1.—A SINGLE KETTLE FURNACE.

[Water is supplied by a ram to barrels, from which it runs by gravity to kettle. The prepared wash is delivered by trough to spray tank. (Original.)]

FIG. 2.—A WELL-ARRANGED PLANT FOR COOKING THE WASH ON A LARGE SCALE. (AFTER R. I. SMITH.)

PLANTS FOR COOKING LIME-SULPHUR WASH.

PLANTS FOR COOKING LIME-SULPHUR WASH.

[Top figure.—A western New York outfit. Middle figure.—An inconvenient cooking plant, the wash being dipped from barrels by hand. Bottom figure.—An outfit with two large tanks for cooking, with boiler between.]

(4) There must be an ample supply of water, preferably so situated that water may be supplied to cooking barrels and spray tanks by gravitation.

When barrels are used as cooking vessels one of two plans of piping is followed. In the first the main steam pipe, which should be of the same size as the outlet at the boiler, extends along the base of the barrels, with a smaller steam discharge pipe leading directly into each barrel, terminating in a single perforated coil (fig. 15, *B*, and Pl. XXXVII, fig. 2). In the other plan the steam is conveyed above the barrels, to which it is supplied by smaller vertical pipes, reaching to within a few inches of the bottom of the barrels, terminating in a double T, with arms of perforated pipe (fig. 15, *A*, and fig. 16).

While the 50-gallon barrel makes a convenient unit as a cooking vessel, some orchardists prefer large round or square tanks (Pl. XXXVIII, bottom figure) in which a large amount of wash can be made up at once, often sufficient for the day's use. By this means it is claimed a saving in fuel and labor is effected. In using large tanks, however, there should be an abundance of perforated pipe along the bottom to secure proper distribution of the steam.

In portions of the country where individual orchards are small, but situated close together, a central cooking plant may often be used in cooperation, or by an individual who supplies the wash during the spraying season to the orchardists of the community. The practicability of this plan has already been demonstrated.

TIME OF APPLICATION OF THE WASH.

Lime-sulphur washes, as herein considered, are suitable only for the treatment of trees which are in a dormant state, being much too strong for application to trees in foliage. Experiments indicate that the best results follow applications in spring, just before the growth of the tree begins. These late applications insure a maximum amount of wash on the trees when the young "lice" begin to appear later in the season from females which may have escaped treatment. The later effect of the wash is quite as important as its direct insecticidal action on the insects when applied. In large commercial orchards, however, it is necessary to begin spraying operations at the first suitable time in spring, or even during favorable periods in the winter, on account of the large amount of work to be done. The unfavorable weather conditions often prevailing during spring and the urgency of other work have led some orchardists to spray in late fall and early winter. The value of fall applications in killing the scale and their effects on the trees have been investigated to some extent by entomologists, principally in Maryland [a] and New York,[b] and by the

[a] Bul. 90, Md. Agr. Exp. Station (1903).

[b] Bul. 273, N. Y. Agr. Exp. Station (1905).

Bureau of Entomology. In general it appears that fall treatment of trees will keep the scale in check, though more or less of injury may result to some fruits, as peach and plum, by the destruction of fruit buds and terminal shoots, varying with the time of application, ripeness of the wood, etc. If spring applications can not be made, late fall or early winter applications are advised; the possible injury to the tree will be in a measure balanced by its increased vigor in growth, due to control of the scale.

EQUIPMENT FOR SPRAYING.

Spraying outfits for applying the lime-sulphur washes are those used for spraying generally. Barrel spray pumps are much used by the smaller orchardists, and tanks holding 100 to 300 gallons, fitted with large hand pumps with double vertical or horizontal cylinders, are used by the larger orchardists. (See Pl. XXXIX, fig. 1.) Less generally, gasoline or other power outfits are employed. Whatever the outfit used, provision should be made for keeping the wash in the barrel or tank thoroughly agitated; the hose should be of ample length and should be fitted with a bamboo extension rod to reach the higher portions of the trees and to protect the sprayers as much as possible. At the junction of the hose and extension rod a stopcock should be provided whereby the spray may be shut off when desired, as in passing from one tree to another. In spraying high trees some form of elevated platform should be provided on the wagon, as shown in Plate XXXIX, figure 2, thus facilitating thorough applications to the tops of the trees.

The spray nozzle is one of the most important parts of the outfit, and many of the nozzles in use by orchardists are practical handicaps to good work. Orchardists are urged to give more attention to this part of their spraying equipment. The Vermorel and nozzles of that type are best, and should always be provided with a plunger for removing any temporary obstruction in the outlet orifice. In spraying the lime-sulphur wash caps should be used with an orifice one-sixteenth of an inch in diameter, and a supply of caps should be kept on hand to replace the worn ones when the spray becomes too coarse. In the operation of spraying a pressure should be maintained of not less than 75 pounds, and preferably much higher. To maintain this with a barrel or tank hand pump with two leads of hose, each with two or more nozzles, requires constant hard work in pumping. The tendency will be to allow the pressure to lighten, with a consequent falling off in efficiency of the spraying. While there is some difference in ease of working of the different makes of hand pumps, the danger of working with too low pressure will always be present, and especially if careless labor is employed. Power outfits are, therefore, advised where their operation is practicable and the orchard interest

FIG. 1.—A GEORGIA HAND-POWER TANK OUTFIT.

FIG. 2.—A GASOLINE POWER OUTFIT USED IN WESTERN NEW YORK. (ORIGINAL.)

OUTFITS USED FOR SPRAYING LIME-SULPHUR WASH.

warrants their purchase. In treating the San Jose scale thorough spraying is particularly important, and especial pains should be taken to coat every part of the tree thoroughly, from the topmost twigs to the ground. When quite dormant, trees may be thoroughly drenched without danger of injury, and excessive spraying is preferable to deficient spraying. During windy weather thorough spraying is often impossible, and under such conditions, or if for any other reason the first treatment has not been satisfactory, a second application is very desirable to reach the places that have been missed during the first treatment.

The caustic, disagreeable character of the wash is frequently complained of by orchardists and orchard workers. Much may be done to remove the objections to its use by spray gangs by supplying the men with rubber coats and gloves. The use of vaseline on the face is advisable in working during windy weather, and clear glass goggles may be used to protect the eyes. Lime-sulphur wash is very hard on the pumps, and these should be thoroughly cleaned at the close of each day's use.

SELF-BOILED WASHES.

The expense of establishing cooking plants and of their operation constitutes an important objection to the lime-sulphur wash, and some attention has been given by entomologists to the devising and testing of washes made simply by the heat generated by the slaking of the lime, or by the additional heat following the addition of caustic soda.

SELF-BOILED LIME-SULPHUR WASH.

This wash is prepared without direct heat by placing in a barrel or other suitable container 40 pounds of good stone lime and adding 15 pounds of flour or flowers of sulphur which has been worked into a paste with water. The lime is started slaking by the addition of 10 or 12 gallons of hot water, and the mixture should be stirred occasionally as the slaking proceeds, the barrel or vessel being kept covered as much as possible. After the lime is all slaked, water is added to bring up to 50 gallons of wash. In the experiments of the Bureau of Entomology this wash has not been satisfactory. Sufficient heat is not generated during the slaking of the lime to bring into solution a sufficient quantity of sulphur.

SELF-BOILED LIME-SULPHUR-CAUSTIC-SODA WASH.

To prepare this wash, place in a suitable barrel or other vessel 30 pounds of good quicklime and start slaking with sufficient hot water to prevent air-slaking. As soon as the slaking is well under way add 15 pounds of sulphur previously worked into a paste with water, and stir thoroughly. Hot water is added from time to time in sufficient

quantity to bring the mixture up to a thin paste. After slaking has ceased add 5 or 6 pounds of commercial caustic soda, stirring until the soda is dissolved. To this should be added sufficient water to bring up to 50 gallons of wash.

RANGE OF USEFULNESS OF LIME-SULPHUR WASHES.

In the foregoing discussion the wash has been considered more particularly with reference to its value in destroying the San Jose scale. There are numerous other insects which may coexist on fruit trees with the San Jose scale, and the wash is very useful in destroying some of these, as well as in reducing fungous diseases. Without doubt most of the scale insects of the subfamily to which the San Jose scale belongs (Diaspinæ) will be controlled by the wash. This has been shown to be the case for Forbes scale (*Aspidiotus forbesii*), West Indian peach scale (*Diaspis pentagona*), the scurfy scale (*Chionaspis furfura*), and the oyster-shell scale (*Lepidosaphes ulmi*). Unfortunately, however, it appears to be ineffective on Lecanium scales, such as the terrapin scale (*Eulecanium nigrofasciatum*). Its value in destroying the winter eggs of aphides affecting the foliage and twigs of the apple has been demonstrated by Prof. J. M. Aldrich,[a] and observations by Mr. Fred Johnson, of this Bureau, in western New York in 1905, indicate that it is quite effective in destroying the eggs of the pear tree Psylla (*Psylla pyri*). There is no doubt of its efficacy in destroying the pear-leaf blister mite (*Eriophyes pyri*), which winters in the adult condition behind the bud scales of its host plant, and also the so-called "silvering mite" of the peach (*Phyllocoptes cornutus*). In California Mr. W. T. Clark[b] has shown that the lime-sulphur wash is entirely satisfactory as a remedy for the peach twig borer (*Anarsia lineatella*), which on the Pacific slope is a very serious enemy of the peach.

It has been demonstrated by Pierce and others that the lime-sulphur wash is practically a specific for peachleaf-curl, and recent experiments at the New York Agricultural Experiment Station[c] indicate that it may be substituted for Bordeaux mixture as the dormant-tree treatment for apple scab. Its usefulness in a similar way for scab on pears is very probable. But few dormant-tree sprays have a greater range of usefulness than lime-sulphur wash. In practice, one thorough application in spring shortly before the buds open is calculated to control effectively not only the San Jose scale, but other scales, excepting lecaniums, and to an important degree the insects and fungous diseases above mentioned on their respective host plants.

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[a] Bul. 40, Idaho Agr. Exp. Sta. (1904).

[b] Bul. 144, Cal. Agr. Exp. Sta. (1902).

[c] Bul. 262, N. Y. Agr. Exp. Sta.

NATIONAL FORESTS AND THE LUMBER SUPPLY.

By Thomas H. Sherrard,
Assistant Forester, Forest Service.

The problem of securing the most effective use of the land concerns the people of the United States as never before. The readjustment of the stock-growing industry to benefit an overcrowded range and the new agriculture—which in the East takes expression in diversified farming, large drainage projects, and more intensive methods and in the West in the great movement for extended irrigation of arid lands and in dry farming—are but phases of its solution. And in no way is the question more urgent than in the use of our forest resources.

From pioneer days almost to the present time every energy was bent to conquer the forest and to win homes from the wilderness. Conversion of the forests into farms and the use of wood in building homes was an essential part of the wonderful development of the nation, but the spirit of destruction, which grew out of the long battle with the forest, survived long after the reason for it was past.

The hardships and difficulties resulting from an inadequate supply of wood and water were first encountered when settlement reached the great treeless plains of the Middle West, and long before a timber famine had been thought of in the East. Almost everywhere a point has now been reached where development of the country is made, not in the face of the forest but with its essential aid.

ECONOMIC PHASES OF THE FOREST PROBLEM.

Early legislation and the propaganda of theorists and sentimentalists are mainly interesting as a matter of history, for they were alike without effect upon the action of the owners of timberland, but certain economic conditions have now become powerful checks to forest destruction.

The north woods of Maine and New York, once so prominent in the lumber activity of the nation, long ago dropped out of sight as lumber-producing regions, although the bulk of the pulpwood used in the manufacture of paper is still drawn from them. The region of the Lake States, which was for many years the undisputed center of the lumber industry, gradually yielded its supremacy to the South and West. As early as 1890 lumber companies which had cut over their holdings in Michigan, Wisconsin, and Minnesota were compelled either to go out of business or to turn elsewhere for available timber. Then followed the rush to the southern pineries and the great virgin forests of the Pacific coast. During recent years the production of

lumber in the southern pine belt has been enormous, and so great have been the inroads upon the available supply of southern pine that it is a question of only a few years, hastened by the construction of the Panama Canal, when the great production of lumber will shift to the Pacific coast. The old process of exhausting the supply of timber in a region and then seeking new fields is very nearly over. Already the industry is turning back on its tracks. A quality of timber is eagerly sought in the Lake States which a few years ago was passed over as utterly worthless, and certain sawmills have depended for a part of their supply upon the recovery of logs which have sunk in the waterways in process of transportation. In the South the whole pine region is being gone over in close search of the old field pine. This inferior and once despised growth of timber is now bought up at prices greatly in excess of those once paid for the magnificent timber of the virgin forests.

Great improvement in logging and sawmill machinery, signal success in reducing the waste in manufacture, wonderful railroad extension, concentration, and systematic organization of producers to reach the consumer most effectively through the markets, have all combined to cheapen the cost of production and increase the profit in the lumber business. Yet the price of lumber has never before been as high as in the year 1906. This increased price is in spite of an increased production which it taxes the railroads to transport.

The price of stumpage is far more stable than that of lumber, and responds very tardily to fluctuations in the lumber market. The usual policy of disposing of Federal and State timber for practically nothing has acted powerfully, particularly in the West, to keep the selling price of stumpage far below its legitimate value. It is not surprising that it has always been impossible for the bulk of the owners of timber to have a broad view of the lumber industry and close acquaintance with the lumber market, for most of the cost of producing lumber lies in logging and manufacture, and the margin of profit has varied widely. The price of stumpage has always been artificially depressed, and has lagged far behind the constantly increasing value of lumber.

ACQUIRING LUMBER UNDER LAND LAWS.

The act of June 3, 1878, generally known as the timber and stone act, provides for the purchase of public timber land at the uniform price of $2.50 per acre. The purpose of Congress in enacting this law was to make it possible for settlers, miners, and other actual users of timber to satisfy their needs. Records of the General Land Office show that in 1904 over 55,000 entries had been made under this act, covering an area of nearly 8,000,000 acres. Probably 10,000,000 acres of carefully selected public timberland has by this time passed into the control of private owners under this law alone.

It is well known that most of the entries under this law have been

made, indirectly, by nonresidents for speculation. And the great bulk of the entries have almost immediately passed into the hands of timber syndicates, with profit to the original entrymen amounting to no more than bare wages. Thus the law has reacted greatly to the disadvantage of the very classes whom it was intended to help, and the bona fide settler and miner and the small sawmill man have seen the public timber rapidly withdrawn and pass into the hands of speculative syndicates.

The same law permits the cutting of timber for domestic purposes from mineral lands. The area classed as mineral land in the timbered portions of the public land is very great, and the construction put by the courts upon the provision of the law that the timber might be used for domestic purposes has been so broad as to include practically every purpose for which timber can be used. This act has never been repealed.

Abuses have grown up under the other laws which provide for the disposition of public land. More land has been disposed of under the "homestead law" than under all other land laws combined. Entries of timberland under the homestead law are common, notably so under the commutation clause, which permits a brief period of residence on condition of a cash payment.

Thus the land laws, while they have provided for the rapid disposal of public timberlands, have tended strongly to the segregation of large holdings of timberland for speculative purposes.

PURCHASE OF NATIONAL FOREST TIMBER.

The acquisition of timberland under the land laws has been cited in order to contrast it emphatically with the purchase of timber itself for immediate use under the National forest laws.

The act of March 1, 1891, which gave to the President the power to set aside National Forests, did not provide for their administration, and therefore effectually locked up timber from use. That of June 4, 1897, enlarged the powers of the Secretary and provided for a protective force.

At first the National Forests had no appreciable effect upon the lumber industry. The Forests largely comprised inaccessible timber, and its purchase was not encouraged. Consumers of wood and other forest products, who were dependent upon the Forests, were confronted with impractical and troublesome regulations. Unnecessary delay in the transaction of business worked added hardship and fostered a feeling of hostility toward National Forests among those who came into closest contact with them, and who should have been made most sensible of their benefits. During succeeding years vast areas of timberland were taken up under the land laws, and cheap timber was on the market in immense quantities.

It was not until the large withdrawals of land by the creation of new National Forests in 1903 and 1904 that bodies of timber attractive

to private enterprise were included. By these withdrawals entries under the timber and stone act and the lieu land law were checked. At the same time the rapid extension of railroads and the great increase in settlement and industrial development in the West were operating to enable the lumberman to enter regions once remote from market.

In February, 1905, the administration of the National Forests was transferred to the Department of Agriculture, and the policy of the greatest legitimate use of all resources of the Forests has been definitely adopted. Under the enlarged powers of the Secretary, regulations governing the cutting of timber have been greatly simplified, and annoying delays in the transaction of business wiped out. An especial effort is made to facilitate applications for the free use of timber and for small purchases.

The effect upon the use of the timber of the National Forests was instantaneous. Money receipts from the sale of timber for the fiscal year ended June 30, 1905, were $50,000. During the present fiscal year (1907) receipts from timber sold will probably exceed half a million dollars and contracts for the sale of timber, extending from one to five years, will reach a value of over 1½ million dollars.

The money return which the Government realizes from these sales is in striking contrast to that received from the sale of timberland under the land laws. Under the timber and stone act timberland could be bought for $2.50 per acre, and under the lieu land law it could be acquired in exchange for denuded and worthless land without money payment. Timber from the Forests is now purchased by the thousand board feet, and payment is made upon the actual scale of the logs when cut. The cut varies from 5,000 to 20,000 feet per acre, so that, at the comparatively low stumpage rate of $2.50 per thousand feet, the Government receives from five to twenty times as much for the timber as it received under the timber and stone act *and retains the land*. To cite a single example: A sale of 12,000,000 feet of timber was recently made on a National Forest in Wyoming, at a rate of $5 per thousand feet. The proceeds from the sale of the timber alone will be $60,000. The timber averages 8,000 feet per acre and covers 1,500 acres. Had the sale been made under the timber and stone law it would have yielded but $3,750 for both timber and land.

It might be argued that the Government is not in the lumber business and that it should dispose of its remaining timberlands as rapidly as possible, leaving it to private enterprise to exploit them. But public opinion is emphatically in favor of a more conservative use of what remains of the National Forests than would be possible were they turned over to lumber companies, whose sole concern would be their quick conversion into cash. The Government has been forced into the lumber business solely that a supply of forest products may be guaranteed to future generations.

The ratio of the present yield of timber cut from the National Forests to that of the whole country, or even to that of the Western

States, is insignificant. Probably 65 per cent of the total stand of merchantable timber within the Forests is located on the Pacific coast, where for a long time the enormous supply of privately owned timber will satisfy most of the demand. This more accessible private timber surrounded the Forests as the meat of an apple surrounds the core. But this belt of private timber has been entirely eaten away in many places, while in others it is locked up for purposes of speculation. The thing to remember, then, is that this immense body of public timber is there as a great reserve against the time when private timberlands will be depleted, and for use as a weapon against monopoly. Already, even on the Pacific coast, actual operators, who are not speculating in timber, but who, if they are to meet the demands of commerce, must have logs to supply their mills, are turning to the National Forests.

The advantages in the purchase of timber from the National Forests to the actual operator, and especially to the sawmill man of small means, are many. There is no large initial investment required in acquiring timberlands and no possibility of annoying litigation over defective title to lands. The purchaser is entirely relieved of taxes and the cost of protection. The Government assumes the entire risk of loss by fire or other causes.

EFFECT ON THE PRICE OF LUMBER.

The first effect of National Forests upon prices, particularly where there is still a great deal of available timber, is to raise the price of stumpage toward its intrinsic value by withdrawing the excess supply of low-priced timber from the market. On the other hand, as the supply of timber dwindles and values are forced upward by holding for speculation, the effect of the Forests will be to check advance in prices and make them lower.

In the Rocky Mountain States and Territories the major part of the small remaining supply of timber is in the National Forests, and here their beneficial effect upon the lumber supply may be more plainly seen than on the Pacific coast. The demand for timber from the Forests throughout this region has come very generally from small sawmills which supply towns and ranches located off the railroads and from mines which use the timber for their own development.

NATIONAL FOREST MANAGEMENT.

In the virgin forest, growth is just about balanced by decay. In the western forests, however, natural deterioration is greatly augmented by forest fires. Destruction of merchantable timber is usually the measure of the damage done by forest fires, but, great as this injury is, vastly more actual loss in forest wealth is caused by the fires which year after year burn, practically unnoticed, in the grass and undergrowth of the forest. While these ground fires do not consume the large trees, seedlings are destroyed outright, growing trees receive injuries which result in their early decay, and the forest floor,

composed of a mold of needles, twigs, and mosses, is burned away. Thus the wonderful recuperative power of the forest is lost. That the damages done by fires can be reduced has been proved on the National Forests by actually reducing them. The great need is that there should be more men on the protective force.

From the forester's standpoint, mature timber should be cut in order to give the small trees more light and a chance to grow and to make way for reproduction. From the standpoint of national economy, the mature timber on the Forests should be utilized as needed for the development of the West, provided the local supply is not reduced below the point of safety. The whole weight of the movement in favor of National Forests is squarely against a reckless use of the timber resources, but it is emphatically in favor of the legitimate use of timber. The points of vital importance are that the remaining supply of timber must be used with the utmost economy and that in every case reproduction must be absolutely assured.

No live timber is cut on the Forests until it has been determined by careful study on the ground that lumbering will not injure the forest. In every sale of timber, rules to insure careful logging are made a condition of the sale. It is often found advisable to remove only the larger, mature trees and to leave the smaller ones, which, although of merchantable size, can be lumbered more profitably when larger. Seed trees are left, whenever necessary, to insure a second crop. In felling timber, vigorous measures are taken to prevent the destruction of promising young trees and to prohibit their use in logging.

In order to protect cut-over areas against fire, the brush, or "slash," is piled and burned, and in dry seasons, when the danger from fire is greatest, the cutting areas are watched or, if necessary, logging is suspended. Waste in logging is effectually prevented by rules framed to apply to the particular class of timber to be cut, and the cutting of low stumps and the use of all the merchantable material in tops and partly unsound logs is enforced by close supervision. Grazing is regulated so that the range is not overcrowded to the injury of the Forest, and if necessary to encourage reproduction it is prohibited altogether. In these and in many other ways the forest is safeguarded.

Far beyond the present influence of the National Forests upon the lumber supply will be their importance in the future. The United States is now facing a serious decrease in the available supply of timber. That from the National Forests will aid greatly to bridge over the period of inevitable lack of mature timber which will last from the time the old trees are gone until the young trees are large enough to take their places. The definite result, therefore, of the sale of timber from the Forests will be to sustain the lumber business, to maintain a steady range of timber values and thus to lessen speculation, and, far more important still, to render possible the uninterrupted development of the great industries dependent upon wood.

APPENDIX.

ORGANIZATION OF THE DEPARTMENT OF AGRICULTURE.[a]

SECRETARY OF AGRICULTURE, James Wilson.

The Secretary exercises personal supervision of public business relating to the agricultural industry. He appoints all the officers and employees of the Department with the exception of the Assistant Secretary and the Chief of the Weather Bureau, who are appointed by the President, and directs the management of all the Bureaus, Divisions, and Offices embraced in the Department. He exercises advisory supervision over agricultural experiment stations which receive aid from the National Treasury, has control of the quarantine stations for imported cattle, of interstate quarantine rendered necessary by sheep and cattle diseases, and of the inspection of cattle-carrying vessels, and directs the inspection of domestic and imported food products, under the meat inspection and pure-food laws. He is charged with the duty of issuing rules and regulations for the protection, maintenance, and care of the National forest reserves. He also is charged with carrying into effect the laws prohibiting the transportation by interstate commerce of game killed in violation of local laws and excluding from importation certain noxious animals, and has authority to control the importation of other animals.

ASSISTANT SECRETARY OF AGRICULTURE, Willet M. Hays.

The Assistant Secretary performs such duties as may be required by law or prescribed by the Secretary. He also becomes Acting Secretary of Agriculture in the absence of the Secretary.

CHIEF CLERK, S. R. Burch.

The Chief Clerk has the general supervision of the clerks and employees; he is charged with the enforcement of the internal regulations of the Department; and is, by law, superintendent of the buildings occupied by the Department of Agriculture. He represents the Department on the Government board of the Jamestown Exposition, Norfolk, Va.

APPOINTMENT CLERK, Joseph B. Bennett.

The Appointment Clerk prepares all papers involved in the making of appointments, transfers, promotions, reductions, details, furloughs, and removals, for the entire Department, and decides all questions relating to the civil-service regulations affecting the same. He has charge of all correspondence of the Department with the Civil Service Commission, and of all certifications and communications issued by the Commission to the Department; and he reports to the Commission all appointments and other changes in the service. He keeps the personal records of all employees of the Department, and is custodian of their oaths of office and efficiency reports. He is also custodian of the Department seal.

SOLICITOR, George P. McCabe.

The Solicitor acts as the legal adviser of the Secretary, and is charged with the preparation and supervision of all legal papers to which the Department is a party, and of all communications to the Department of Justice and to the various officers thereof, including United States attorneys. He examines and approves, in advance of issue, all orders and regulations promulgated by the Secretary under statutory authority; represents the Department in all legal proceedings arising under the various laws intrusted to the Department for execution, and prosecutes applications of employees of the Department for patents. He is also a member of the Board of Food and Drug Inspection.

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[a] The organization of the Department here given is in accordance with the act approved March 4, 1907, making appropriations for the fiscal year ending June 30, 1908, and shows changes in personnel to April 1, 1907.

Chief of Supply Division, Cyrus B. Lower.

The Supply Division has charge of purchases of supplies and materials paid for from the general funds of the Department.

Weather Bureau (corner Twenty-fourth and M streets NW.).—*Chief*, Willis L. Moore; *Assistant Chief*, Henry E. Williams; *Chief Clerk*, Daniel J. Carroll; *Editor of Monthly Weather Review*, Cleveland Abbe; *In charge of Division of Meteorological Records*, Frank H. Bigelow; *In charge of Instrument Division*, Charles F. Marvin; *In charge of Forecast Division*, Edward B. Garriott; *In charge of Special Research and Forecaster*, Alfred J. Henry; *In charge of River and Flood Service and Forecaster*, Harry C. Frankenfield; *In charge of Weather Bureau accounts*, Edgar B. Calvert. *Chiefs of Division: Climatological*, James Berry; *Publications*, John P. Church; *Telegraph*, Jesse H. Robinson; *Ocean Meteorology*, James Page; *Supplies*, Frank M. Cleaver; *Librarian*, Herbert H. Kimball.

The Weather Bureau has charge of the forecasting of weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gaging and reporting of river stages; the maintenance and operation of seacoast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton, rice, sugar, and other interests; the display of frost and cold-wave signals; the distribution of meteorological information in the interests of agriculture and commerce; and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or are essential for the proper execution of the foregoing duties.

Bureau of Animal Industry.—*Chief*, A. D. Melvin; *Assistant Chief*, A. M. Farrington; *Chief Clerk*, E. B. Jones; *Chief of Inspection Division*, Rice P. Steddom; *Chief of Quarantine Division*, Richard W. Hickman; *Chief of Pathological Division*, John R. Mohler; *Chief of Biochemic Division*, M. Dorset; *Chief of Dairy Division*, Ed. H. Webster; *Chief of Division of Zoology*, B. H. Ransom; *Superintendent of Experiment Station*, E. C. Schroeder; *Animal Husbandman*, George M. Rommel; *Editor*, James M. Pickens.

The Bureau of Animal Industry makes investigations as to the existence of dangerous communicable diseases of live stock, superintends the measures for their control and extirpation, makes original investigations as to the nature and prevention of such diseases, and reports on the condition and the means of improving the animal industries of the country. It supervises the interstate movement of cattle, and inspects live stock, meats, and meat-food products intended for interstate and foreign commerce. It conducts feeding and breeding experiments. It has charge of the inspection of import and export animals, of the inspection of vessels for the transportation of export animals, and of the quarantine stations for imported animals. It also has supervision of the manufacture, interstate commerce, and export of renovated butter.

Bureau of Plant Industry.—*Pathologist and Physiologist, and Chief*, Beverly T. Galloway; *Pathologist and Physiologist, and Assistant Chief*, Albert F. Woods; *Chief Clerk*, James E. Jones; *Editor*, J. E. Rockwell; *Pathologist in charge of Laboratory of Plant Pathology*, Erwin F. Smith; *Pathologist in charge of Investigations of Diseases of Fruits*, Merton B. Waite; *Physiologist in charge of Plant Life History Investigations*, Walter T. Swingle; *Physiologist in charge of Cotton and Tobacco Breeding Investigations*, Archibald D. Shamel; *Physiologist in charge of Corn Breeding Investigations*, Charles P. Hartley; *Physiologist in charge of Alkali and Drought Resistant Plant Breeding Investigations*, Thomas H. Kearney; *Physiologist in charge of Soil Bacteriology and Water Purification Investigations*, Karl F. Kellerman; *Bionomist in charge of Bionomic Investigations of Tropical and Subtropical Plants*, Orator F. Cook; *Physiologist in charge of Drug and Poisonous Plant Investigations and Tea Culture Investigations*, Rodney H. True; *Physicist in charge of Physical Laboratory*, Lyman J. Briggs; *Expert in charge of Crop Technology Investigations*, Nathan A. Cobb; *Botanist in charge of Taxonomic Investigations*, Frederick V. Coville; *Agriculturist in charge of Farm Management Investigations*, William J. Spillman; *Cerealist in charge of Grain Investigations*, Mark A. Carleton; *Horticulturist in charge of Arlington Experimental Farm*, Lee C. Corbett; *Pathologist in charge of Sugar Beet Investigations*, Charles O. Townsend; *Agriculturist in charge of Western Agricultural Extension Investigations*, Carl S. Scofield; *Agriculturist in charge of Dry Land Agriculture Investigations*, E. Channing Chilcott; *Pomologist in charge of Pomological Collections*, Gustavus B. Brackett; *Pomologists in charge of Field Investigations in Pomology*, William A. Taylor and G. Harold Powell; *Superintendent of Experimental Gardens*

and Grounds, Edward M. Byrnes; *Superintendent of Vegetable Testing Gardens*, W. W. Tracy, sr.; *Agricultural Explorer in charge of Seed and Plant Introduction*, David Fairchild; *Assistant in charge of Congressional Seed Distribution*, Lisle Morrison; *Agrostologist in charge of Forage Crop Investigations*, Charles V. Piper; *Botanist in charge of Seed Laboratory*, Edgar Brown; *Expert in charge of Grain Standardization*, John D. Shanahan; *Pathologist in charge of Subtropical Laboratory and Garden, Miami, Fla.*, Ernst A. Bessey; *Expert in charge of Plant Introduction Garden, Chico, Cal.*, August Mayer; *Pomologist in charge of South Texas Garden, Brownsville, Tex.*, Edward C. Green; *Special Agent in charge of Cotton Culture Farms*, Seaman A. Knapp, Lake Charles, La.

The Bureau of Plant Industry studies plant life in all its relations to agriculture. Its work is classified under the general subjects of Pathological Investigations, Physiological Investigations, Taxonomic Investigations, Agronomic Investigations, Horticultural Investigations, and Seed and Plant Introduction Investigations.

Forest Service (Atlantic Building, 928–930 F street NW.).—*Forester and Chief*, Gifford Pinchot; *Associate Forester*, Overton W. Price; *Law Officer*, P. P. Wells; *Editor*, Herbert A. Smith; *Dendrologist*, George B. Sudworth; *Branch of Grazing, Assistant Forester in Charge*, Albert F. Potter; *Branch of Operation, Assistant Forester in Charge*, James B. Adams; *Chief, Office of Maintenance*, Hermon C. Metcalf; *Fiscal Agent and Chief, Office of Accounts*, George E. King; *Chief, Office of Organization*, C. S. Chapman; *Assistant Chief, Office of Organization*, Clyde Leavitt; *Chief, Office of Engineering*, W. E. Herring; *Chief, Office of Lands*, George F. Pollock; *Branch of Silviculture, Assistant Forester in Charge*, William T. Cox; *Chief, Office of Extension*, Samuel N. Spring; *Chief, Office of Silvics*, Raphael Zon; *Chief, Office of Management*, E. E. Carter; *Assistant Chief, Office of Management*, W. G. Weigle; *Branch of Products—Assistant Forester in Charge*, William L. Hall; *Chief, Office of Wood Utilization*, R. S. Kellogg; *Chief, Office of Wood Preservation*, C. G. Crawford; *Chief, Office of Publication*, Findley Burns.

The Forest Service has charge of the administration of the National forests, and conducts examinations on the public lands to determine the propriety of making changes in the boundaries of existing National forests and of withdrawing other areas suitable for new forests; gives practical assistance in the conservative handling of State and private forest lands; investigates methods of planting and kinds of trees for planting, and gives practical assistance to tree planters; studies commercially valuable trees to determine the best means of using and reproducing them; tests the strength and durability of construction timbers, railroad ties, and poles, and determines the best methods of extending their life through preservative treatment; and studies forest fires, the effects of grazing on forest land, turpentine orcharding, and other forest problems.

Bureau of Chemistry (corner Fourteenth and B streets SW.).—*Chemist and Chief*, Harvey W. Wiley; *Board of Food and Drug Inspection*, H. W. Wiley, F. L. Dunlap, and G. P. McCabe; *Chief of Division of Foods*, W. D. Bigelow; *Chiefs of Food and Drug Inspection Laboratories:* New York, R. E. Doolittle; Philadelphia, C. S. Brinton; Boston, B. H. Smith; Chicago, A. L. Winton; New Orleans, C. W. Harrison; San Francisco, R. A. Gould; St. Paul, A. S. Mitchell; *Chief of Sugar Laboratory*, C. A. Browne, jr.; *Chief of Miscellaneous Laboratory*, J. K. Haywood; *Chief of Dairy Laboratory*, G. E. Patrick; *Chief of Plant Analysis Laboratory*, C. C. Moore; *Chief of Drug Laboratory*, L. F. Kebler; *Chief of Contracts Laboratory*, P. H. Walker; *Chief of Leather and Paper Laboratory*, F. P. Veitch; *Chief of Micro-chemical Laboratory*, B. J. Howard; *Chief Clerk*, M. T. Read.

The Bureau of Chemistry investigates methods proposed for the analysis of plants, fertilizers, and agricultural products, and makes such analyses as pertain in general to the interests of agriculture. The work on foods includes the analysis of adulterated products, experiments to determine the effect of adulterants on the human organism, the investigation of food products imported into the United States, and the examination of foods and drugs in accordance with the Food and Drugs Act, June 30, 1906. The Bureau does chemical work for some of the other Bureaus and Divisions of the Department, and for other Departments of the Government which apply to the Secretary of Agriculture for such assistance.

Bureau of Soils (208–214 Thirteenth street SW.).—*Chief*, Milton Whitney; *Chief Clerk*, A. G. Rice; *In charge of Soil Laboratories*, Frank K. Cameron; *In charge of Soil Survey*, Jay A. Bonsteel; *In charge of Alkali Reclamation Investigations*, Clarence W. Dorsey; *In charge of Tobacco Investigations*, George T. McNess; *In charge of*

Soil Management, Frank D. Gardner; *In charge of Fertility Investigations*, Oswald Schreiner.

The Bureau of Soils is intrusted with the investigation, survey, and mapping of soils; the investigation of the cause and prevention of the rise of alkali in the soil, and the drainage of soils; and the investigation of the methods of growing, curing, and fermentation of tobacco in the different tobacco districts.

BUREAU OF ENTOMOLOGY.—*Entomologist and Chief*, L. O. Howard; *Entomologist and Acting Chief in absence of Chief*, C. L. Marlatt; *Chief Clerk*, R. S. Clifton; *In charge of Breeding Experiments*, F. H. Chittenden; *In charge of Forest Insect Investigations*, A. D. Hopkins; *In charge of Cotton Boll Weevil Investigations*, W. D. Hunter; *In charge of Cereal and Forage-plant Insect Investigations*, F. M. Webster; *In charge of Deciduous-fruit Insect Investigations*, A. L. Quaintance; *In charge of Apicultural Investigations*, E. F. Phillips; *In charge of Gipsy and Brown-tail Moth Work*, D. M. Rogers; *Engaged in White Fly Investigations*, A. W. Morrill; *In charge of Gipsy Moth Laboratory*, E. S. G. Titus; *Engaged in Silk Investigations*, C. J. Gilliss; *Assistant in charge of Editorial Work*, R. P. Currie; *Librarian*, Mabel Colcord.

The Bureau of Entomology obtains and disseminates information regarding injurious insects affecting field crops, fruits, small fruits, truck crops, forests and forest products, and stored products; studies insects in relation to diseases of man and other animals and as animal parasites; experiments with the introduction of beneficial insects and with the fungous and other diseases of insects; and conducts experiments and tests with insecticides and insecticide machinery. It is further charged with investigations in apiculture and sericulture. The information gained is disseminated in the form of general reports, bulletins, and circulars. Museum work is done in connection with the Division of Insects of the National Museum, and insects are identified for experiment stations and other public institutions and for private individuals.

BUREAU OF BIOLOGICAL SURVEY.—*Biologist and Chief*, C. Hart Merriam; *Administrative Assistant and Acting Chief in absence of Chief*, H. W. Henshaw; *Assistant in charge of Economic Investigations*, A. K. Fisher; *Assistant in charge of Game Preservation*, T. S. Palmer; *Assistant in charge of Geographic Distribution*, Vernon Bailey.

The Bureau of Biological Survey studies the geographic distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial and the destruction of injurious species. It is charged with carrying into effect the provisions of the Federal law for the supervision of interstate commerce in game and the importation and protection of birds, and certain provisions of the law for the protection of game in Alaska.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.—*Chief and Disbursing Clerk*, A. Zappone; *Assistant Chief*, Edgar B. Calvert; *Auditor*, Everett D. Yerby; *Cashier*, M. E. Fagan.

The Division of Accounts and Disbursements audits, adjusts, and pays all accounts and claims against the Department; decides questions involving the expenditure of public funds; prepares advertisements and schedules for annual supplies and letters of authority; writes, for the signature of the Secretary, all letters to the Treasury Department pertaining to fiscal matters; issues requisitions for the purchase of supplies and requests for passenger and for freight transportation; prepares the annual estimates of appropriations, and transacts all other business relating to the financial interests of the Department.

DIVISION OF PUBLICATIONS.—*Editor and Chief*, Geo. Wm. Hill; *Editor and Assistant Chief*, Joseph A. Arnold; *Associate Editor*, B. D. Stallings; *Assistant in charge of Document Section*, R. B. Handy; *Chief Clerk*, A. I. Mudd; *Assistant in charge of Indexing*, Charles H. Greathouse; *Assistant in charge of Illustrations*, Louis S. Williams.

The Division of Publications exercises general supervision of the Department printing and illustrations, edits all publications of the Department (with the exception of those of the Weather Bureau), has charge of the printing and Farmers' Bulletin funds, and distributes all Department publications with the exception of those issued by the Weather Bureau and those turned over by law to the Superintendent of Documents for sale at the price affixed by him. It issues, in the form of press notices, official information of interest to agriculturists, and distributes to agricultural publications

and writers notices and synopses of Department publications, and has charge of all correspondence with the Government Printing Office.

BUREAU OF STATISTICS.—*Statistician and Chief*, Victor H. Olmsted; *Associate Statistician*, C. C. Clark; *Assistant Statistician*, Nat C. Murray; *Chief Clerk*, E. J. Lundy; *Chief of Division of Foreign Markets*, George K. Holmes; *Chief of Division of Domestic Crop Reports*, F. J. Blair; *Crop Reporting Board:* Victor H. Olmsted, Charles C. Clark, Nat C. Murray, George K. Holmes, and one member selected from month to month from the corps of field agents and of State statistical agents.

The Statistician collects information as to the condition, production, etc., of the principal crops and the status of farm animals through State agents, each of whom is assisted by a corps of local reporters, through separate corps of county, township, and cotton correspondents, through traveling agents, and through a special foreign correspondent, assisted by consular, agricultural, and commercial authorities. He records, tabulates, and coordinates statistics of agricultural production, distribution, and consumption, the authorized data of governments, institutes, societies, boards of trade, and individual experts; prepares special statistical bulletins upon domestic and foreign agricultural subjects, and issues a monthly crop report for the information of producers and consumers. Special bulletins are published giving information of domestic and foreign trade and of the conditions under which foreign trade may be extended. Investigations are made of land tenures, cost of producing farm products, country-life education, transportation, and other lines of rural economics.

LIBRARY.—*Librarian*, Josephine A. Clark; *Assistant Librarian*, Claribel R. Barnett.

The Librarian has charge of the Library and supervises the arrangement and cataloguing of books, the preparation of bibliographies and similar publications, and the purchase of new books. The mailing lists for the distribution of Department publications to foreign countries are under the supervision of the Librarian.

OFFICE OF EXPERIMENT STATIONS.—*Director*, A. C. True; *Assistant Director and Editor of Experiment Station Record*, E. W. Allen; *Chief of Editorial Division*, W. H. Beal; *Chief of Division of Insular Stations*, W. H. Evans; *Special Agent, Alaska*, C. C. Georgeson; *Special Agent, Hawaii*, Jared G. Smith; *Special Agent, Porto Rico*, D. W. May; *Chief of Nutrition Investigations*, C. F. Langworthy; *Chief of Irrigation and Drainage Investigations*, Elwood Mead; *Farmers' Institute Specialist*, John Hamilton; *Expert in Agricultural Education*, D. J. Crosby; *Chief Clerk*, Mrs. C. E. Johnston.

The Office of Experiment Stations represents the Department in its relation to the experiment stations, which are now in operation in all the States and Territories, and directly manages the experiment stations in Alaska, Porto Rico, and Hawaii. It seeks to promote the interests of agricultural education and investigation throughout the United States. It collects and disseminates general information regarding agricultural schools, colleges, and stations, and publishes accounts of agricultural investigations at home and abroad. It also indicates lines of inquiry for the stations, aids in the conduct of cooperative experiments, reports upon their expenditures and work, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established. In a similar way it aids in the development of the farmers' institutes throughout the United States. It is charged with investigations on the nutritive value and economy of human foods. It conducts investigations of the laws and institutions relating to irrigation in different regions, the use of irrigation waters, the removal of seepage and surplus waters by drainage, and the use of different kinds of power and machinery for irrigation and other agricultural purposes.

OFFICE OF PUBLIC ROADS.—*Director*, Logan Waller Page; *Assistant Director*, Allerton S. Cushman; *Chief Engineer*, Vernon M. Peirce; *Chief of Records*, Maurice O. Eldridge; *Testing Engineer*, Philip L. Wormeley, jr.; *Chief Clerk*, James Edmund Pennybacker, jr.

The Office of Public Roads collects and disseminates information concerning systems of road management throughout the United States; conducts investigations and experiments regarding road-building materials and methods of road construction; makes chemical and physical tests of road materials and materials of construction relating to agriculture; gives expert advice on road administration and road construction; demonstrates the best methods of construction, and prepares publications on these subjects.

APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE FOR THE FISCAL YEARS ENDING JUNE 30, 1905, 1906, AND 1907.

Object of appropriation.	1905.	1906.	1907.
Salaries, Department of Agriculture	$482,300.00	$814,970.00	$785,8[illegible]
Library, Department of Agriculture	10,000.00	8,040.00	10,000.00
Contingent Expenses, Department of Agriculture	37,000.00	37,000.00	37,000.00
Collecting Agricultural Statistics	139,500.00	98,[illegible]	a 112,[illegible]
Bureau of Plant Industry, General Expenses			b [illegible]2,301.28
Botanical Investigations and Experiments	67,500.00	63,840.00	c
Entomological Investigations	70,000.00	[illegible]	307,500.00
Vegetable Pathological Investigations	150,000.00	155,[illegible]	c
Grain Investigations, 1906		25,000.00	15,000.00
Rent of Quarters, Plant Bureau (deficiency act)	2,500.00		
Biological Investigations	34,[illegible]	44,420.00	44,420.00
Pomological Investigations	43,500.00	35,[illegible]	c
Laboratory, Department of Agriculture	135,000.00	[illegible]	d 395,920.00
Forestry Investigations	388,000.00	79[illegible]	[illegible]
National Forests, Administration, etc., 1907 and 1908			1,052,500.00
Wichita Forest and Game Preserve			15,000.00
Survey and Report, Appalachian and White Mountain Watersheds, 1907 and 1908			25,000.00
Testing Timbers, Louisiana Purchase Exposition, St. Louis, Mo. (deficiency act)	10,000.00		
Experimental Gardens and Grounds, Department of Agriculture	25,000.00	2[illegible]	c
Soil Investigations	170,000.00	170,000.00	185,000.00
Grass and Forage Plant Investigations	42,[illegible]	[illegible]	c
Greenhouses, Department of Agriculture, 1904–1905	25,000.00		c
Agricultural Experiment Stations [for stations under Hatch and Adams acts: $810,000, 1905; $794,000, 1906; $1,056,000, 1907]	90,000.00	74,[illegible]	e 84,[illegible]
Nutrition Investigations	20,000.00	20,000.00	20,000.00
Public Road Inquiries	35,000.00	37,[illegible]	37,[illegible]
Cotton Boll Investigations	250,000.00	190,000.00	[illegible]
Publications, Department of Agriculture	210,000.00	f 1[illegible]	g 152,250.00
Sugar Investigations	7,500.00	7,500.00	c
Purchase and Distribution of Valuable Seeds	290,000.00	242,[illegible]	242,920.00
Salaries and Expenses, Bureau of Animal Industry	1,525,000.00	1,45[illegible]	[illegible]
Eradicating Cattle Ticks, 1907 and 1908			107,500.00
Bureau of Animal Industry (deficiency act)		[illegible]	
Irrigation Investigations	67,500.00	74,500.00	122,[illegible]
Tea Culture Investigations	10,000.00	8,500.00	c
Arlington Experimental Farm	20,000.00	20,000.00	c
Building, Department of Agriculture	250,000.00	950,000.00	[illegible]
Total	4,[illegible]	5,71[illegible]	
WEATHER BUREAU.			
Salaries, Weather Bureau	190,[illegible]	191,340.00	194,[illegible]
Fuel, Lights, and Repairs, Weather Bureau	8,000.00	10,000.00	10,000.00
Contingent Expenses, Weather Bureau	10,000.00	10,000.00	10,000.00
General Expenses, Weather Bureau	1,064,300.00	1,0[illegible]	[illegible]
Buildings, Weather Bureau	48,500.00	53,000.00	53,000.00
Cables and Land Lines, Weather Bureau	27,000.00	35,000.00	
Salaries, Station Employees, Weather Bureau			541,550.00
Total, Weather Bureau	1,3[illegible]	1,[illegible]	
Grand total	5,944,540.00	7,112,[illegible]	

a Includes $4,966 for Foreign Markets Investigations.

b Includes $11,[illegible] for rent and repairs; $5,000 for Ozark Mountain investigations; $[illegible]541.28 received from sale of fruits and vegetables; also appropriations heretofore made under the names of Botanical Investigations, Vegetable Pathological Investigations, Pomological Investigations, Experimental Gardens and Grounds, Grass and Forage Plant Investigations, Sugar Investigations, Tea Culture Investigations, and Arlington Experimental Farm.

c Included under Bureau of Plant Industry.

d Includes $[illegible] for enforcement of Food and Drugs Act.

e Expenses of Office of Experiment Stations and includes $[illegible] from sale of Experiment Station card indexes in 1907.

f Does not include $[illegible] for the Yearbook and $[illegible] in general printing fund.

g Does not include $[illegible] in general printing fund.

AGRICULTURAL COLLEGES AND OTHER INSTITUTIONS IN THE UNITED STATES HAVING COURSES IN AGRICULTURE.[a]

College instruction in agriculture is given in the colleges and universities receiving the benefits of the acts of Congress of July 2, 1862, and August 30, 1890, which are now in operation in all the States and Territories, except Alaska, Hawaii, and Porto Rico. The total number of these institutions is 65, of which 63 maintain courses of instruction in agriculture. In 21 States the agricultural colleges are departments of the State universities. In 15 States and Territories separate institutions having courses in agriculture are maintained for the colored race. All of the agricultural colleges for white persons and several of those for negroes offer four-year courses in agriculture and its related sciences leading to bachelors' degrees, and many provide for graduate study. About 55 of these institutions also provide special, short, and correspondence courses in the different branches of agriculture, including agronomy, horticulture, animal husbandry, poultry raising, cheese making, dairying, sugar making, rural engineering, farm mechanics, and other technical subjects. The officers of the agricultural colleges engage quite largely in conducting farmers' institutes and various other forms of college extension. The agricultural experiment stations with very few exceptions are departments of the agricultural colleges. The total number of persons engaged in the work of education and research in the land-grant colleges and the experiment stations in 1906 was 5,637; the number of students in these colleges, 63,471; the number of students (white) in the four-year college courses in agriculture, 2,779; in short and special courses, 4,764. There were also 1,798 students in agriculture in the separate institutions for negroes. With a few exceptions, each of these colleges offers free tuition to residents of the State in which it is located. In the excepted cases scholarships are open to promising and energetic students; and, in all, opportunities are found for some to earn part of their expenses by their own labor. The expenses are from $125 to $300 for the school year.

Agricultural colleges and other institutions in the United States having courses in agriculture.

State or Territory.	Name of institution.	Location.	President.
Alabama	Alabama Polytechnic Institute	Auburn	C. C. Thach, LL. D.
	Agricultural and Mechanical College for Negroes.	Normal	W. H. Councill, Ph. D.
Arizona	University of Arizona	Tucson	K. C. Babcock, Ph. D.
Arkansas	University of Arkansas	Fayetteville	J. N. Tillman, B. LL.
California	University of California	Berkeley	B. I. Wheeler, Ph. D., LL. D.
Colorado	The State Agricultural College of Colorado.	Fort Collins	B. O. Aylesworth, LL. D., Litt. D.
Connecticut	Connecticut Agricultural College.	Storrs	R. W. Stimson, A. M.
Delaware	Delaware College	Newark	G. A. Harter, Ph. D.
	State College for Colored Students.	Dover	W. C. Jason, M. A.
Florida	University of Florida	Gainesville	Andrew Sledd, Ph. D., LL. D.
	Florida State Normal and Industrial College.	Tallahassee	N. B. Young, M. A.
Georgia	Georgia State College of Agriculture and Mechanic Arts.	Athens	H. C. White, Ph. D., LL. D.
	Georgia State Industrial College.	Savannah	R. R. Wright, LL. D.
Idaho	University of Idaho	Moscow	J. A. MacLean, Ph. D., LL. D.
Illinois	University of Illinois	Urbana	E. J. James, Ph. D., LL. D.
Indiana	Purdue University	Lafayette	W. E. Stone, Ph. D.
Iowa	Iowa State College of Agriculture and the Mechanic Arts.	Ames	A. B. Storms, D. D., LL. D.
Kansas	Kansas State Agricultural College.	Manhattan	E. R. Nichols, A. M.
Kentucky	Agricultural and Mechanical College of Kentucky.	Lexington	J. K. Patterson, Ph. D., LL. D.
	The Kentucky Normal and Industrial Institute for Colored Persons.	Frankfort	J. S. Hathaway, M. A., M. D.
Louisiana	Louisiana State University and Agricultural and Mechanical College.	Baton Rouge	T. D. Boyd, LL. D.
	Southern University and Agricultural and Mechanical lege.	New Orleans	H. A. Hill.

[a] Including only institutions established under the land-grant act of July 2, 1862.

Agricultural colleges and other institutions in the United States having courses in agriculture—Continued.

State or Territory.	Name of institution.	Location.	President.
Maine	The University of Maine	Orono	G. E. Fellows, Ph. D., LL. D.
Maryland	Maryland Agricultural College	College Park	R. W. Silvester, M. S.
	Princess Anne Academy, Eastern Branch, Md. Agr. Coll.	Princess Anne	F. Trigg, M. A.
Massachusetts	Massachusetts Agricultural College.	Amherst	K. L. Butterfield, A. M.
Michigan	Michigan State Agricultural College.	Agricultural College.	J. L. Snyder, Ph. D.
Minnesota	The University of Minnesota	St. Anthony Park	C. Northrop, LL. D.
Mississippi	Mississippi Agricultural and Mechanical College.	Agricultural College.	J. C. Hardy, LL. D.
	Alcorn Agricultural and Mechanical College.	Lorman	L. J. Rowan, B. S.
Missouri	The University of Missouri	Columbia	R. H. Jesse, LL. D.
	Lincoln Institute	Jefferson City	B. F. Allen, LL. D.
Montana	The Montana College of Agriculture and Mechanic Arts.	Bozeman	J. M. Hamilton, M. S.
Nebraska	The University of Nebraska	Lincoln	E. B. Andrews, LL. D.
Nevada	Nevada State University	Reno	J. E. Stubbs, D. D., LL. D.
New Hampshire	The New Hampshire College of Agriculture and the Mechanic Arts.	Durham	W. D. Gibbs, M. S.
New Jersey	Rutgers Scientific School, the New Jersey State College for the Benefit of Agriculture and the Mechanic Arts.	New Brunswick	W. H. S. Demarest.
New Mexico	The New Mexico College of Agriculture and Mechanic Arts.	Agricultural College.	Luther Foster, M. S. A.
New York	Cornell University	Ithaca	J. G. Schurman, D. Sc., LL. D.
North Carolina	The North Carolina College of Agriculture and Mechanic Arts.	West Raleigh	G. T. Winston, LL. D.
	The Agricultural and Mechanical College for the Colored Race.	Greensboro	J. B. Dudley, LL. D.
North Dakota	North Dakota Agricultural College.	Agricultural College.	J. H. Worst, LL. D.
Ohio	Ohio State University	Columbus	W. O. Thompson, D. D., LL. D.
Oklahoma	Oklahoma Agricultural and Mechanical College.	Stillwater	A. C. Scott, LL. M.
	Agricultural and Normal University.	Langston	I. E. Page, M. A.
Oregon	Oregon State Agricultural College.	Corvallis	T. M. Gatch, Ph. D.
Pennsylvania	The Pennsylvania State College	State College	J. A. Beaver.
Rhode Island	Rhode Island College of Agriculture and Mechanic Arts.	Kingston	Howard Edwards, LL. D.
South Carolina	Clemson Agricultural College of South Carolina.	Clemson College	P. H. Mell, Ph. D., LL. D.
	The Colored Normal, Industrial, Agricultural, and Mechanical College of South Carolina.	Orangeburg	T. E. Miller, LL. D.
South Dakota	South Dakota Agricultural College.	Brookings	R. L. Slagle, Ph. D.
Tennessee	University of Tennessee	Knoxville	Brown Ayres, Ph. D., LL. D.
Texas	Agricultural and Mechanical College of Texas.	College Station	H. H. Harrington, LL. D.
	Prairie View State Normal and Industrial College.	Prairie View	E. L. Blackshear.
Utah	The Agricultural College of Utah.	Logan	W. J. Kerr, D. Sc.
Vermont	University of Vermont and State Agricultural College.	Burlington	M. H. Buckham, D. D., LL. D.
Virginia	The Virginia Agricultural and Mechanical College and Polytechnic Institute.	Blacksburg	J. M. McBryde, Ph. D., LL. D.
	The Hampton Normal and Agricultural Institute.	Hampton	H. B. Frissell, D. D., LL. D.
Washington	The State College of Washington.	Pullman	E. A. Bryan, LL. D.
West Virginia	West Virginia University	Morgantown	D. B. Purinton, Ph. D., LL. D.
	The West Virginia Colored Institute.	Institute	J. McH. Jones, A. M.
Wisconsin	University of Wisconsin	Madison	C. R. Van Hise, Ph. D.
Wyoming	University of Wyoming	Laramie	F. M. Tisdel, Ph. D.

AGRICULTURAL EXPERIMENT STATIONS OF THE UNITED STATES, THEIR LOCATIONS, DIRECTORS, AND PRINCIPAL LINES OF WORK.

Station, location, and director.	Principal lines of work.
Alabama (College), Auburn:	
J. F. Duggar	Chemistry; botany; soils; analysis of fertilizers and food materials; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; entomology; dairying.
Alabama (Canebrake), Uniontown:	
J. M. Richeson [a]	Agronomy; horticulture; floriculture; plant breeding; diseases of plants and animals.
Alabama (Tuskegee), Tuskegee Institute:	
G. W. Carver	Agronomy; horticulture; diseases of plants; animal industry; poultry investigations; dairying.
Arizona, Tucson:	
R. H. Forbes	Chemistry; botany; agronomy; horticulture; improvement of ranges; animal husbandry; irrigation.
Arkansas, Fayetteville:	
W. G. Vincenheller	Chemistry; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; dairying; entomology; poultry experiments; nursery inspection.
California, Berkeley:	
E. J. Wickson [b]	Chemistry; soils; bacteriology; fertilizer control; agronomy; horticulture, including viticulture and zymology; botany; meteorology; entomology; animal husbandry; dairying; poultry experiments; irrigation and drainage; silviculture; reclamation of alkali lands; animal and plant pathology; nutrition investigations.
Colorado, Fort Collins:	
L. G. Carpenter	Chemistry; meteorology; agronomy; horticulture; forestry; plant breeding; diseases of plants; animal husbandry; veterinary investigations; entomology; irrigation.
Connecticut (State), New Haven:	
E. H. Jenkins	Chemistry; inspection of fertilizers, foods, feeding stuffs, Babcock test apparatus, and nurseries; diseases of plants; plant breeding; forestry; agronomy; entomology.
Connecticut (Storrs), Storrs:	
L. A. Clinton	Food and nutrition of man and animals; dairy bacteriology; agronomy; horticulture; plant breeding; poultry culture; dairying.
Delaware, Newark:	
Harry Hayward	Chemistry; bacteriology; mycology; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; dairying; entomology.
Florida, Gainesville:	
P. H. Rolfs	Chemistry; agronomy; horticulture; diseases of plants; feeding experiments; veterinary science; entomology.
Georgia, Experiment:	
M. V. Calvin	Chemistry; agronomy; bacteriology; horticulture; plant breeding; plant diseases; entomology; animal husbandry; dairying.
Idaho, Moscow:	
H. T. French	Chemistry; physics; botany; agronomy; horticulture; plant breeding; diseases of plants; entomology; animal husbandry; irrigation.
Illinois, Urbana:	
E. Davenport	Chemistry; soil physics; bacteriology; agronomy; horticulture; forestry; plant breeding; diseases of plants and animals; animal husbandry; dairying.
Indiana, Lafayette:	
Arthur Goss	Chemistry; soils; agronomy; horticulture; plant breeding; animal husbandry; dairying; diseases of plants and animals; entomology.
Iowa, Ames:	
C. F. Curtiss	Chemistry; botany; agronomy; horticulture; plant breeding; forestry; diseases of plants; animal husbandry; poultry investigations; dairying; entomology; rural engineering; good roads investigations.
Kansas, Manhattan:	
C. W. Burkett	Chemistry; soils; horticulture; plant breeding; agronomy; animal husbandry; poultry experiments; diseases of animals; dairying; entomology; extermination of prairie dogs and gophers; irrigation.
Kentucky, Lexington:	
M. A. Scovell	Chemistry; soils; inspection of fertilizers, foods, feeding stuffs, orchards, and nurseries; agronomy; horticulture; plant breeding; animal husbandry; dairying; diseases of plants; entomology; apiculture.

[a] Assistant director. [b] Acting director.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
Louisiana (Sugar), New Orleans: W. R. Dodson	Chemistry; bacteriology; soils; agronomy; horticulture; sugar making; drainage; irrigation.
Louisiana (State), Baton Rouge: W. R. Dodson	Geology; botany; bacteriology; soils; inspection of fertilizers, foods, and Paris green; agronomy; horticulture; animal husbandry; diseases of animals; entomology.
Louisiana (North), Calhoun: W. R. Dodson	Chemistry; soils; fertilizers; agronomy; horticulture; animal husbandry; stock raising; poultry experiments; dairying.
Maine, Orono: C. D. Woods	Chemistry; botany; inspection of foods, fertilizers, commercial feeding stuffs, seeds, and creamery glassware; mycology; pathology; nutrition of man and animals; poultry raising; entomology.
Maryland, College Park: H. J. Patterson	Chemistry; fertilizers; agronomy; horticulture; plant breeding; diseases of plants and animals; breeding of plants; animal husbandry; poultry experiments; dairying; entomology.
Massachusetts, Amherst: W. P. Brooks	Chemistry; meteorology; inspection of fertilizers, commercial feeding stuffs, creamery glassware, and nurseries; agronomy; horticulture; diseases of plants and animals; animal husbandry; dairying; entomology; effect of electricity on plant growth.
Michigan, Agricultural College: C. D. Smith	Chemistry; analysis and control of fertilizers; bacteriology; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; stable hygiene; entomology.
Minnesota, St. Anthony Park, St. Paul: W. M. Liggett	Chemistry; soils; fertilizers; agronomy; horticulture; forestry; diseases of plants and animals; food and nutrition investigations; plant breeding; animal husbandry; dairying; entomology; farm management; farm statistics.
Mississippi, Agricultural College: W. L. Hutchinson	Fertilizers; agronomy; horticulture; biology; plant breeding; animal husbandry; diseases of animals; poultry culture; dairying; entomology; agricultural engineering.
Missouri (College), Columbia: H. J. Waters	Chemistry; soil survey; botany; agronomy; horticulture; diseases of plants and animals; animal husbandry; plant breeding; dairying; entomology.
Missouri (Fruit), Mountain Grove: Paul Evans	Horticulture; entomology; inspection of orchards and nurseries.
Montana, Bozeman: F. B. Linfield	Chemistry; meteorology; botany; agronomy; dry farming; horticulture; animal husbandry; poultry experiments; dairying; entomology; irrigation and drainage.
Nebraska, Lincoln: E. A. Burnett	Chemistry; botany; meteorology; soils; agronomy; horticulture; plant breeding; diseases of plants and animals; forestry; animal husbandry; dairying; entomology; irrigation.
Nevada, Reno: J. E. Stubbs	Chemistry; botany; soils; meteorology; agronomy; horticulture; forestry; plant breeding; animal diseases; animal husbandry; entomology; irrigation.
New Hampshire, Durham: W. D. Gibbs	Chemistry; botany; agronomy; horticulture; plant breeding; forestry; animal husbandry; poultry experiments; dairying; entomology.
New Jersey (State), New Brunswick: E. B. Voorhees; New Jersey (College), New Brunswick: E. B. Voorhees	Chemistry; oyster culture; botany; analysis of fertilizers, foods, and commercial feeding stuffs; agronomy; horticulture; plant breeding; diseases of plants and animals; dairy husbandry; entomology; soil bacteriology; irrigation.
New Mexico, Agricultural College: Luther Foster	Chemistry; botany; soils; agronomy; dry farming; horticulture; animal husbandry; dairying; entomology; irrigation.
New York (State), Geneva: W. H. Jordan	Chemistry; bacteriology; meteorology; fertilizers; inspection of creamery glassware, feeding stuffs, fertilizers, and Paris green; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; poultry experiments; dairying; entomology; irrigation.
New York (Cornell), Ithaca: L. H. Bailey	Chemistry; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; poultry experiments; dairying; entomology.

Agricultural experiment stations of the United States, their locations, directors, and principal lines of work—Continued.

Station, location, and director.	Principal lines of work.
North Carolina, Raleigh: B. W. Kilgore	Chemistry; soils; agronomy; horticulture; animal husbandry; diseases of animals and plants; poultry experiments; dairying; tests of farm machinery.
North Dakota, Agricultural College: J. H. Worst	Chemistry; soils; botany; agronomy; plant breeding; horticulture; forestry; diseases of plants and animals; animal husbandry; poultry experiments; drainage; inspection and analysis of foods, spraying materials, paints, drugs, and proprietary products.
Ohio, Wooster: C. E. Thorne	Chemistry; soils; agronomy; botany; horticulture; plant breeding; forestry; diseases of plants; animal husbandry; entomology.
Oklahoma, Stillwater: W. L. English	Chemistry; agronomy; horticulture; plant breeding; forestry; botany; bacteriology; diseases of plants and animals; animal husbandry; entomology.
Oregon, Corvallis: J. Withycombe	Chemistry; bacteriology; soils; fertilizers; agronomy; horticulture; plant breeding and selection; diseases of plants; animal husbandry; poultry experiments; dairying; entomology; irrigation.
Pennsylvania State College: H. P. Armsby	Chemistry; meteorology; fertilizers; horticulture; plant diseases; agronomy; animal husbandry; animal nutrition; dairying.
Rhode Island, Kingston: H. J. Wheeler	Chemistry; meteorology; soils; inspection of fertilizers and feeding stuffs; agronomy; horticulture; plant breeding; poultry experiments.
South Carolina, Clemson College: J. N. Harper	Chemistry; inspection of fertilizers; soils; botany; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; dairying; veterinary science; entomology.
South Dakota, Brookings: J. W. Wilson	Chemistry; botany; agronomy; horticulture; plant breeding; diseases of plants and animals; animal husbandry; entomology.
Tennessee, Knoxville: H. A. Morgan	Chemistry; soil investigations; inspection of fertilizers; agronomy; horticulture; plant breeding; seeds; weeds; diseases of plants and animals; animal husbandry; poultry investigations; apiculture; dairying; entomology.
Texas, College Station: J. W. Carson [a]	Chemistry; soils; agronomy; horticulture; animal husbandry; diseases of animals; entomology; irrigation; seed testing; feed inspection.
Utah, Logan: P. A. Yoder	Chemistry; alkali soil investigations; agronomy; horticulture; diseases of plants and animals; animal husbandry; dairying; poultry experiments; entomology; irrigation; arid farming.
Vermont, Burlington: J. L. Hills	Chemistry; botany; bacteriology; inspection of fertilizers, feeding stuffs, and creamery glassware; agronomy; horticulture; diseases of plants; animal husbandry; dairying.
Virginia, Blacksburg: A. M. Soule	Chemistry; geology; biology; agronomy; horticulture; plant breeding; bacteriology; mycology; analysis of foods and soils; inspection of orchards; animal husbandry; veterinary science; dairying; entomology; cider and vinegar making; ferments.
Washington, Pullman: E. A. Bryan	Chemistry; botany; bacteriology; soils; agronomy; horticulture; plant breeding; diseases of plants; animal husbandry; veterinary science; dairying; entomology; irrigation.
West Virginia, Morgantown: J. H. Stewart	Chemistry; inspection of fertilizers, orchards, and nurseries; soils; agronomy; horticulture; diseases of plants and animals; animal husbandry; poultry experiments; entomology.
Wisconsin, Madison: W. A. Henry	Chemistry; bacteriology; soils; agronomy; horticulture; plant breeding; animal husbandry; dairying; irrigation, drainage, and agricultural engineering.
Wyoming, Laramie: B. C. Buffum	Chemistry; mycology; botany; meteorology; soils; range improvement; fertilizers; agronomy; plant selection; food analysis; animal husbandry; irrigation.

[a] Vice-director.

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

President, L. H. Bailey, dean of College of Agriculture and director of New York (Cornell) Experiment Station, Ithaca, N. Y.; secretary-treasurer, J. L. Hills, director Vermont Experiment Station, Burlington, Vt.

OFFICIALS IN CHARGE OF FARMERS' INSTITUTES.

Farmers' Institute Specialist, Department of Agriculture.

John Hamilton, Washington, District of Columbia.

State Superintendents.

State or Territory.	Name of official.	Post-office.
Alabama	C. A. Cary, Alabama Polytechnic Institute	Auburn.
	G. W. Carver, Director Agricultural Experiment Station	Tuskegee Institute.
Alaska	C. C. Georgeson, Agricultural Experiment Station	Sitka.
Arizona	R. H. Forbes, Director Agricultural Experiment Station	Tucson.
Arkansas	W. G. Vincenheller, Director Agricultural Experiment Station.	Fayetteville.
California	E. J. Wickson, University of California	Berkeley.
Colorado	H. M. Cottrell, Director of Farmers' Institutes	Fort Collins.
Connecticut	J. F. Brown, Secretary State Board of Agriculture	N. Stonington.
	J. G. Schwink, Sec'y Connecticut Dairymen's Association.	Hartford.
	H. C. C. Miles, Secretary Connecticut Pomological Society.	Milford.
Delaware	Wesley Webb, Director of Farmers' Institute	Dover.
	H. Hayward, Director Agricultural Experiment Station.	Newark.
Florida	R. W. Clothier, University of Florida	Gainesville.
Georgia	H. C. White, President State College of Agriculture	Athens.
	Harvie Jordan, Director of Farmers' Institutes	Atlanta.
Hawaii	J. G. Smith, Agricultural Experiment Station	Honolulu.
Idaho	H. T. French, Director Agricultural Experiment Station.	Moscow.
Illinois	Frank H. Hall, Secretary Farmers' Institutes	Springfield.
Indiana	W. C. Latta, Purdue University	Lafayette.
Iowa	J. C. Simpson, Secretary State Board of Agriculture	Des Moines.
Kansas	J. H. Miller, Superintendent of Farmers' Institutes	Manhattan.
Kentucky	Hubert Vreeland, Commissioner of Agriculture	Frankfort.
Louisiana	Charles Schuler, Commissioner of Agriculture	Baton Rouge.
Maine	A. W. Gilman, Commissioner of Agriculture	Augusta.
Maryland	W. L. Amoss, Director of Farmers' Institutes	Benson.
Massachusetts	J. L. Ellsworth, Secretary State Board of Agriculture	Boston.
Michigan	L. R. Taft, Superintendent of Farmers' Institutes	Agricultural College.
Minnesota	O. C. Gregg, Director of Farmers' Institutes	Lynd.
Mississippi	E. R. Lloyd, Director of Farmers' Institutes	Agricultural College.
Missouri	Geo. B. Ellis, Secretary State Board of Agriculture	Columbia.
Montana	F. B. Linfield, Director Agr. Experiment Station	Bozeman.
Nebraska	E. A. Burnett, Director Agricultural Experiment Station.	Lincoln.
Nevada	J. E. Stubbs, President Nevada State University	Reno.
New Hampshire	N. J. Bachelder, Secretary State Board of Agriculture	Concord.
New Jersey	Franklin Dye, Secretary State Board of Agriculture	Trenton.
New Mexico	John D. Tinsley, Superintendent of Farmers' Institutes	Agricultural College.
New York	F. E. Dawley, Director of Farmers' Institutes	Fayetteville.
North Carolina	S. L. Patterson, Commissioner of Agriculture	Raleigh.
North Dakota	E. E. Kaufman, Director of Farmers' Institutes	Fargo.
Ohio	T. L. Calvert, Secretary State Board of Agriculture	Columbus.
Oklahoma	C. A. McNabb, Secretary Board of Agriculture	Guthrie.
Oregon	J. Withycombe, Director Agricultural Experiment Station	Corvallis.
Pennsylvania	A. L. Martin, Deputy Secretary of Agriculture	Harrisburg.
Porto Rico	D. W. May, Agricultural Experiment Station	Mayaguez.
Rhode Island	John J. Dunn, Secretary State Board of Agriculture	Providence.
South Carolina	J. N. Harper, Director Agricultural Experiment Station.	Clemson College.
South Dakota	A. E. Chamberlain, Superintendent of Farmers' Institutes.	Howard.
Tennessee	W. W. Ogilvie, Commissioner of Agriculture	Nashville.
Texas	J. W. Carson, Director of Farmers' Institutes	College Station.
Utah	P. A. Yoder, Director Agr. Experiment Station	Logan.
Vermont	Geo. Aitken, Secretary State Board of Agriculture	Woodstock.
Virginia	G. W. Koiner, Commissioner of Agriculture	Richmond.
	A. M. Soule, Director Agricultural Experiment Station	Blacksburg.
Washington	E. E. Elliott, Agricultural College	Pullman.
West Virginia	H. E. Williams, Assistant Secretary of Agriculture	Charleston.
Wisconsin	G. B. McKerrow, Director Farmers' Institutes	Madison.
Wyoming	B. C. Buffum, Director Agricultural Experiment Station	Laramie.

AMERICAN ASSOCIATION OF FARMERS' INSTITUTE WORKERS.

President, E. A. Burnett, director of Agricultural Experiment Station, Lincoln, Nebr.; secretary-treasurer, John Hamilton, Farmers' Institute Specialist, U. S. Department of Agriculture, Washington, D. C.

STATE OFFICIALS IN CHARGE OF AGRICULTURE.[a]

Commissioners of Agriculture.

State or Territory.	Name of official.	Post-office.
Alabama	J. A. Wilkinson	Montgomery.
Arkansas	Guy B. Tucker	Little Rock.
Florida	B. E. McLin	Tallahassee.
Georgia	T. G. Hudson	Atlanta.
Idaho	Allen Miller, Com'r of Immigration, etc	Boise.
Kentucky	Hubert Vreeland	Frankfort.
Louisiana	Charles Schuler	Baton Rouge.
Maine	A. W. Gilman	Augusta.
Montana	J. A. Ferguson	Helena.
New Mexico	J. W. Raynolds, Secretary of State	Santa Fe.
New York	Chas. A. Wieting	Albany.
North Carolina	S. L. Patterson	Raleigh.
North Dakota	W. C. Gilbreath	Bismarck.
Pennsylvania	N. B. Critchfield, Secretary of Agriculture	Harrisburg.
Philippine Islands	W. C. Welborn, Chief, Bureau of Agriculture	Manila.
Porto Rico	Lawrance H. Grahame, Commissioner of the Interior.	San Juan.
South Carolina	E. J. Watson	Columbia.
Tennessee	W. W. Ogilvie	Nashville.
Texas	R. T. Milner	Austin.
Virginia	Geo. W. Koiner	Richmond.
Washington	Sam H. Nichols, Secretary of State	Olympia.

Secretaries of State Boards of Agriculture.

California	J. A. Filcher	Sacramento.
Colorado	A. M. Hawley	Fort Collins.
Connecticut	J. F. Brown	North Stonington.
Delaware	Wesley Webb	Dover.
Hawaii	C. S. Holloway	Honolulu.
Illinois	W. C. Garrard	Springfield.
Indiana	Chas. Downing	Indianapolis.
Iowa	J. C. Simpson	Des Moines.
Kansas	F. D. Coburn	Topeka.
Maryland	Wm. T. P. Turpin, Supt. of Immigration	Centerville.
Massachusetts	J. L. Ellsworth	Boston.
Michigan	Addison M. Brown	Agricultural College.
Minnesota	E. W. Randall, Sec. State Ag'l Society	St. Paul.
Missouri	George B. Ellis	Columbia.
Nebraska	W. R. Mellor	Lincoln.
Nevada	Louis Bevier	Carson City.
New Hampshire	N. J. Bachelder	Concord.
New Jersey	Franklin Dye	Trenton.
North Carolina	T. K. Bruner	Raleigh.
Ohio	T. L. Calvert	Columbus.
Oklahoma	C. A. McNabb	Guthrie.
Oregon	F. A. Welch	Salem.
Rhode Island	John J. Dunn	Providence.
South Dakota	C. N. McIlvaine	Huron.
Vermont	George Aitken	Woodstock.
West Virginia	J. B. Garvin	Charleston.
Wisconsin	John M. True	Madison.
Wyoming	C. T. Johnston, State Engineer	Cheyenne.

[a] Officials of Territories and island dependencies are included. So far as learned, Arizona, Mississippi, and Utah have no State official charged with agricultural interests, but letters addressed to the Secretary of State would probably receive attention.

NATIONAL DAIRY ASSOCIATIONS.

Name of organization.	Secretary.	Post-office.
National Association of Dairy Instructors and Investigators.	C. B. Lane	U. S. Department of Agriculture, Washington, D. C.
Association of State and National Food and Dairy Departments.	R. M. Allen	Lexington, Ky.
National Dairy Union	Charles Y. Knight	154 Lake street, Chicago.
National Creamery Buttermakers' Association	E. Sudendorf	154 Washington street, Chicago.
Boston Cooperative Milk Producers' Association.	W. A. Hunter	10 Florence street, Worcester, Mass.
Five States Milk Producers' Association	H. T. Coon	Homer, N. Y.

AMERICAN NATIONAL LIVE STOCK ASSOCIATION.

President, Murdo Mackenzie, Trinidad, Colo.; secretary, W. M. Tomlinson, Denver.

AMERICAN ASSOCIATION OF LIVE STOCK HERD BOOK SECRETARIES.

President, C. R. Thomas, Independence, Mo.; secretary, Charles F. Mills, Springfield, Ill.

NATIONAL WOOL GROWERS' ASSOCIATION.

President, Francis E. Warren, Cheyenne; secretary, George S. Walker, Cheyenne.

THE CORN-BELT MEAT PRODUCERS' ASSOCIATION.

President, A. L. Ames, Buckingham, Iowa; secretary, H. C. Wallace, Des Moines, Iowa.

PROTECTION AGAINST CONTAGION FROM FOREIGN CATTLE.

An act of Congress of August 28, 1894, prohibits the importation of cattle and cattle hides, but by the act of March 2, 1895, making appropriations for the Department of Agriculture, it is provided that the prohibition may be suspended by the President whenever the Secretary of Agriculture shall certify to the President what countries or parts of countries are free from contagious or infectious diseases of domestic animals. The President, by proclamation of November 8, 1895, lifted the embargo with reference to Norway, Sweden, Holland, Great Britain, Ireland, the Channel Islands, and the countries of North, Central, and South America so as to admit cattle under sanitary regulations prescribed by the Secretary of Agriculture; also from all countries so as to admit hides under regulations prescribed by the Secretary of the Treasury.

STOCK BREEDERS' ASSOCIATIONS.[a]

Names and addresses of stock association secretaries, with breeds and numbers[b] of registered live stock in United States, December 31, 1906.

CATTLE.

Breed.	Secretary.	Post-office.	Number registered.		Number living.	
			Male.	Female.	Male.	Female.
Aberdeen Angus	Thos. McFarlane	Union Stock Yards, Chicago, Ill.	38,188	48,094	27,496	34,904
Ayrshire	C. M. Winslow	Brandon, Vt.	9,[illegible]	20,885	(c)	(c)
Devon	L. P. Sisson	Newark, Ohio	8,084	13,717	3,500	10,000
Dutch Belted	H. B. Richards	Easton, Pa.	573	1,265	(c)	(c)
Galloway	C. W. Gray	Union Stock Yards, Chicago, Ill.	16,620	11,080	8,370	6,480
Guernsey	Wm. H. Caldwell	Peterboro, N. H.	10,682	19,889	6,000	12,000
Hereford	C. R. Thomas	225 W. 12th st., Kansas City, Mo.	112,780	115,[illegible]	45,000	60,000
Holstein Friesian	Frederick L. Houghton	Brattleboro, Vt.	46,651	95,067	14,199	31,750
Jersey	J. J. Hemingway	8 W. 17th st., New York, N. Y.	71,967	193,978	(c)	(c)
Polled Durham	Fletcher S. Hines	Indianapolis, Ind.	5,403	6,480	3,935	4,845
Red Polled	H. A. Martin	Gotham, Wis.	14,001	25,00[illegible]	5,500	10,500
Shorthorn	John W. Groves	Union Stock Yards, Chicago, Ill.	249,800	391,000	87,430	176,220
Sussex	Overton Lea	Nashville, Tenn.	78	185	50	100
Swiss, Brown	C. D. Nixon	Owego, N. Y.	2,159	3,150	300	1,500

[a] Under the provisions of paragraph 473 of the act of July 24, 1897, amended March 3, 1903, any animal imported specially for breeding purposes shall be admitted free, provided that no such animal shall be admitted free unless pure bred, of a recognized breed, and duly registered in the book of record established for that breed. The Secretary of the Treasury, upon the advice of the Secretary of Agriculture, issued, April 24, 1903, regulations for the importation of animals under this law, and designated the recognized breeds and the books of record established for these breeds.

[b] Owing to a change in date of making up the books of breeders' associations no new figures could be obtained to show the numbers of registered stock for December 31, 1906. The numbers in the table are for December 31, 1905.

[c] No data.

Names and addresses of stock association secretaries, with breeds and numbers of registered live stock in United States, December 31, 1906—Continued.

HORSES.

Breed.	Secretary.	Post-office.	Number registered.		Number living.	
			Male.	Female.	Male.	Female.
Cleveland Bay	R. P. Stericker	80 Chestnut ave., W. Orange, N. J.	1,236	502	1,050	400
Clydesdale	R. B. Ogilvie	Union Stock Yards, Chicago, Ill.	a 12,370		(b)	(b)
Coach, French	Chas. C. Glenn	Columbus, Ohio	130	4	125	4
Coach, French	Duncan E. Willett	Maple ave. and Harrison st., Oak Park, Ill.				
Coach, German	J. Crouch	Lafayette, Ind	1,656	246	1,500	225
Coach, German (Oldenburg).	C. E. Stubbs	Fairfield, Iowa	260	23	190	14
Draft, Belgian	J. D. Connor, jr	Wabash, Ind	2,056	266	2,055	265
Draft, French	C. E. Stubbs	Fairfield, Iowa	9,000	5,000	(b)	(b)
Hackney	A. H. Godfrey	Tichenor Grand Bldg. 61st and Broadway, New York City.	c 726	c 1,542	c 684	c 1,416
Morgan	H. T. Cutts	Middlebury, Vt	c 5,021	c 2,800	c 3,765	c 2,100
Percheron	Geo. W. Stubblefield.	Union Stock Yards, Chicago, Ill.	1,640	1,460	19,000	12,000
Percheron	Charles C. Glenn	Columbus, Ohio	928	102	913	94
Saddle Horse, American.	I. B. Nall	Louisville, Ky	d 2,529	3,549	(b)	(b)
Shetland Pony	Mortimer Levering	Lafayette, Ind	2,300	3,500	2,000	2,500
Shire	Charles Burgess	Wenona, Ill	6,062	2,148	(b)	(b)
Suffolk	Alex. Galbraith	Janesville, Wis	159	88	a 150	
Thoroughbred	James E. Wheeler	571 Fifth ave., New York, N. Y.	a 45,309		(b)	(b)
Trotter, American	Wm. H. Knight	355 Dearborn st., Chicago, Ill.	42,597	c 152,700	(b)	(b)
Jacks and Jennies	J. W. Jones	Columbia, Tenn	1,000	750	750	500

SHEEP.

Breed.	Secretary.	Post-office.	Number registered.		Number living.	
			Male.	Female.	Male.	Female.
Cheviot	F. E. Dawley	Fayetteville, N. Y	a 10,700		575	2,650
Cotswold	F. W. Harding	Waukesha, Wis	a 36,610		a 14,000	
Dorset Horn	J. E. Wing	Mechanicsburg, Ohio.	1,335	3,703	1,000	2,800
Hampshire Down	Comfort A. Tyler	Nottawa, Mich	5,573	12,844	3,030	9,000
Leicester	A. J. Temple	Cameron, Ill	3,538	5,437	2,972	4,567
Lincoln	Bert Smith	Charlotte, Mich	5,754	8,246	4,100	5,900
Merino (Delaine)	H. G. McDowell	Canton, Ohio	a 9,401		a 6,900	
Merino (Delaine)	George A. Henry	R. F. D. 8, Bellefontaine, Ohio.	8,000	14,300	2,500	8,000
Merino (Delaine)	R. P. Berry	R. F. D. 3, Eighty-four, Pa.	c 5,054	c 11,259	c 1,500	c 3,000
Merino (Delaine)	J. B. Johnson	248 W. Pike st., Canonsburg, Pa.	6,805	11,599	1,500	5,000
Merino (French)	Dwight Lincoln	Milford Center, Ohio	a 34,075		(b)	(b)
Merino (German)	E. M. Moore	Orchard Lake, Mich	162	191	105	175
Merino (Spanish)	E. N. Ball	Ann Arbor, Mich	12,550	37,700	400	4,300
Merino (Spanish)	Wesley Bishop	R. F. D. 1, Delaware, Ohio.	16,691	33,384	2,842	8,035
Merino (Spanish)	J. H. Earll	Skaneateles, N. Y	7,916	11,912	280	1,875
Merino (Spanish)	J. P. Ray	R. F. D. 3, E. Bloomfield, N. Y.	1,275	1,500	100	200
Merino (Spanish)	C. A. Chapman	Middlebury, Vt	a 217,850		(b)	(b)
Oxford Down	W. A. Shafor	Hamilton, Ohio	c 32,798		(b)	(b)
Shropshire	Mortimer Levering	Lafayette, Ind	100,000	134,000	20,000	40,000
Southdown	Frank S. Springer	Springfield, Ill	a 19,933		a 10,200	
Suffolk	Geo. W. Franklin	Des Moines, Iowa	a 1,013		a 550	

a Total of males and females. b No data. c Estimate for 1904. d Includes geldings.

Names and addresses of stock association secretaries, with breeds and numbers of registered live stock in United States, December 31, 1906—Continued.

HOGS.

Breed.	Secretary.	Post-office.	Number registered.		Number living.	
			Male.	Female.	Male.	Female.
Berkshire	Frank S. Springer	510 E. Monroe st., Springfield, Ill.	[a] 88.080		[a] 33.000	
Cheshire	Ed S. Hill	Freeville, N. Y	1.225	2.115	275	575
Chester White	Ernest Freigau	Columbus, Ohio	5.665	8.912	600	2.000
Chester Ohio Improved.	J. C. Hiles	Cleveland, Ohio	3.403	9.000	1,800	6,200
Duroc Jersey	T. B. Pearson	Thorntown, Ind	8.026	18.450	([b])	([b])
Duroc Jersey	Robert J. Evans	Peoria, Ill	21.800	55.000	[a] 30.000	
Hampshire (Thin Rind).	E. C. Stone	Armstrong, Ill	294	540	155	387
Poland China	W. M. McFadden	Union Stock Yards, Chicago, Ill.	52.331	130.620	27,000	68.000
Poland China	A. M. Brown	Drawer 16, Winchester, Ind.	32,000	72.000	10.000	23,000
Poland China	Geo. F. Woodworth	Maryville, Mo	39.008	93.234	2.000	18.000
Poland China	H. P. Wilson	Gadsden, Tenn	691	1.030	400	600
Tamworth	E. N. Ball	Ann Arbor, Mich	[c] 1.949		[c] 1,200	
Yorkshire	Harry G. Krum	White Bear Lake, Minn.	2,860	3.640	2.000	3.200

[a] Total of males and females. [b] No data. [c] Estimate for 1904.

SANITARY OFFICERS IN CHARGE OF LIVE STOCK INTERESTS.

State or Territory.	Name and post-office.	Official position.
Alabama	C. A. Cary, Auburn	State veterinarian.
Arizona	J. D. Carter, Prescott	Secretary live-stock sanitary commission.
	J. C. Norton, Phoenix	Veterinarian.
Arkansas	R. R. Dinwiddie, Fayetteville	State veterinarian.
California	Charles Keane, Sacramento	Do.
Colorado	L. B. Sylvester, Denver	President State board of stock inspection commissioners.
	Charles G. Lamb, Denver	State veterinary surgeon.
Connecticut	Heman O. Averill, Hartford	Commissioner for domestic animals.
Delaware	Alex. Lowber, Wilmington	Secretary State board of health.
	H. P. Eves, Newark	Instructor in veterinary science, Delaware College.
Florida	Thomas J. Mahaffy, Jacksonville	Veterinarian, State board of health.
Georgia	Thos. G. Hudson, Atlanta	Commissioner of agriculture.
Hawaii	Victor A. Nörgaard, Honolulu	Territorial veterinarian.
Idaho	George E. Noble, Boise	State veterinarian.
Illinois	H. E. Wadsworth, Springfield	Secretary board of live-stock commissioners.
	J. M. Wright, 1827 Wabash ave., Chicago.	State veterinarian.
Indiana	A. W. Bitting, Lafayette	Do.
Iowa	Paul O. Koto, Forest City	State veterinary surgeon.
Kansas	John D. Baker, Peabody	Live-stock sanitary commissioner.
Kentucky	F. T. Eisenman, Louisville	State veterinarian.
Louisiana	W. H. Dalrymple, Baton Rouge	Veterinarian State experiment station.
Maine	F. O. Beal, Bangor	Board of cattle commissioners.
	John M. Deering, Saco	
	Frank S. Adams, Bowdoinham	
Maryland	G. Allen Jarman, Chestertown	Chief veterinary inspector.
	Wade H. D. Warfield, Baltimore	Secretary live-stock sanitary board.
Massachusetts	Austin Peters, Boston	Chief of cattle bureau of State board of agriculture.
Michigan	William M. Morris, Cass City	State veterinarian.
	H. H. Hinds, Stanton	President State live-stock sanitary commission.
Minnesota	S. H. Ward, St. Paul	Secretary State live-stock sanitary board.
	C. E. Cotton, Minneapolis	Veterinarian live-stock sanitary board.
	H. M. Bracken, St. Paul	Secretary State board of health.
Mississippi	J. C. Robert, Agricultural College	Professor of veterinary science.
Missouri	D. F. Luckey, Columbia	State veterinarian.
	Geo. B. Ellis, Columbia	Secretary State board of agriculture.
Montana	M. E. Knowles, Helena	State veterinarian.
	W. G. Preuitt, Helena	Secretary live-stock commission.
Nebraska	Charles A. McKimm, Lincoln	State veterinarian.
Nevada	I. W. O'Rourke, Reno	Do.

Sanitary officers in charge of live stock interests—Continued.

State or Territory.	Name and post-office.	Official position.
New Hampshire	N. J. Bachelder, Concord	Secretary board of cattle commissioners.
New Jersey	E. B. Voorhees, New Brunswick	President State board of agriculture.
New Mexico	W. C. Barnes, Las Vegas	Secretary cattle sanitary board.
	Harry F. Lee, Albuquerque	Secretary sheep sanitary board.
New York	C. A. Wieting, Albany	Commissioner department of agriculture.
	W. H. Kelly, Albany	Chief veterinarian.
North Carolina	Tait Butler, Raleigh	State veterinarian.
	S. L. Patterson, Raleigh	Commissioner of agriculture.
North Dakota	W. F. Crewe, Devils Lake	State veterinarian.
Ohio	Paul Fischer, Columbus	Do.
	T. L. Calvert, Columbus	Secretary State live-stock commission.
Oklahoma	C. J. Davis, Guthrie	Territorial veterinarian.
	Thomas Morris, Guthrie	Secretary live-stock sanitary commission.
Oregon	William McLean, Portland	State veterinarian.
	Wm. H. Lytle, Pendleton	Sheep inspector.
Pennsylvania	Leonard Pearson, Philadelphia	State veterinarian.
Porto Rico	Thos. A. Allen, San Juan	Veterinary inspector, health office.
Rhode Island	John S. Pollard, Providence	Veterinarian State board of agriculture.
	John J Dunn, Providence	Secretary State board of agriculture.
South Carolina	Louis A. Klein, Clemson College	State veterinarian.
South Dakota	Thos. H. Hicks, Milbank	Do.
Tennessee	R. H. Kittrell, Nashville	State live-stock commissioner.
Texas	J. H. Wilson, Quanah	Secretary live-stock sanitary commission.
Utah	John Austin, Heber City	President State board of sheep commissioners.
Vermont	H. S. Wilson, Arlington	Cattle commissioner.
Virginia	J. G. Ferneyhough, Blacksburg	State veterinarian.
Washington	S. B. Nelson, Pullman	Do.
West Virginia	J. B. Garvin, Charleston	Secretary board of agriculture.
Wisconsin	David Roberts, Janesville	State veterinarian.
	John M. True, Madison	Secretary State sanitary board.
Wyoming	William F. Pflaeging, Cheyenne	State veterinarian.
	George S. Walker, Cheyenne	Secretary State board of sheep commissioners.

FORESTRY ASSOCIATIONS.

American Forestry Association.—President, Hon. James Wilson, Secretary of Agriculture; vice-presidents, Edward Everett Hale, F. E. Weyerhaeuser, James W. Pinchot, B. E. Fernow, John L. Kaul; secretary, Thomas E. Will, Washington, D. C.

International Society of Arboriculture.—President, Gen. William J. Palmer, Colorado Springs, Colo.; vice-president, Henry John Elwes, F. R. S., Colesborne, Cheltenham, England; secretary, J. P. Brown, Connersville, Ind.

Society of American Foresters.—President, Gifford Pinchot, Washington, D. C.; secretary, George B. Sudworth, Washington, D. C.

SCHOOLS OF FORESTRY.

Yale University, Forest School, New Haven, Conn.—A two-years graduate course, leading to the degree of Master of Forestry. Under the direction of the officers of the Yale Forest School, a two-months summer course, July and August, is conducted at Milford, Pike County, Pa. Prof. Henry S. Graves, Director.

Biltmore Forest School, Biltmore, N. C.—Course covers entire year; daily lectures in all branches of applied forestry, elements of botany, mathematics, geology, law, and political economy; practical work, especially lumbering operations, on the domain of the Biltmore estate; forest investigations. Dr. C. A. Schenck, Director.

University of Michigan, Forest School, part of the general Department of Literature, Science, and the Arts, Ann Arbor, Mich.—A two-years graduate course leading to the degree of Master of Science in Forestry. Filibert Roth, Professor of Forestry.

Harvard University, Forest School, Cambridge, Mass.—A four-years undergraduate course, in connection with the Lawrence Scientific School. R. T. Fisher, in charge of curriculum.

Pennsylvania State College, Forest School, State College, Pa.—A four-years undergraduate course, in connection with the State Department of Agriculture.

Courses in forestry are now given at the University of Maine, Orono, Me., Gordon E. Tower, in charge; the Michigan State Agricultural College, Agricultural College,

Mich., E. E. Bogue, in charge; Iowa State College, Ames, Iowa, H. P. Baker, in charge; University of Nebraska, Lincoln, Nebr., Frank G. Miller, in charge; Mississippi Agricultural and Mechanical College, Agricultural College, Miss., George L. Clothier, in charge; University of Georgia, Athens, Ga., Alfred Akerman, in charge; Colorado College, Colorado Springs, Colo., Wm. C. Sturgis, dean; Purdue University, Lafayette, Ind., Prof. John M. Coulter, in charge; University of Minnesota, St. Anthony Park, Minn., Prof. Samuel B. Green, in charge; Berea College, Berea, Ky., W. L. Flanery, in charge; North Dakota School of Forestry, Bottineau, N. Dak., J. Allen Kemp, president.

A course of lectures is given annually at the Massachusetts State Agricultural College, Amherst, by Frank Wm. Rane, State Forester of Massachusetts; at the Maryland Agricultural College, College Park, by Fred W. Besley, State Forester of Maryland; at the University of Wisconsin, Madison, by Edward M. Griffith, State Forester of Wisconsin; and at the Colorado Agricultural College, Fort Collins, by Hugh P. Baker, Professor of Forestry at the Iowa State College.

NATIONAL BEE KEEPERS' ASSOCIATION.

President, L. A. Aspinwall, Jackson, Mich.; secretary, J. A. Green, Grand Junction, Colo.; general manager and treasurer, N. E. France, Platteville, Wis.

NATIONAL ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

President, H. A. Morgan, Knoxville, Tenn.; secretary, A. F. Burgess, 20 John street, Reading, Mass.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

President, John P. Street, New Haven, Conn.; secretary, H. W. Wiley, Chemist, Department of Agriculture, Washington, D. C.

NATIONAL HORTICULTURAL AND KINDRED SOCIETIES.

Name of organization.	Secretary.	Post-office.
American Apple Growers' Congress	T. C. Wilson	Hannibal, Mo.
American Association of Nurserymen	George C. Seager	Rochester, N. Y.
American Carnation Society	Albert M. Herr	Lancaster, Pa.
American Cranberry Growers' Association	A. J. Rider	Hammonton, N. J.
American Federation of Horticultural Societies	Chas. E. Bassett	Fennville, Mich.
American Institute Farmers' Club	Wm. A. Eagleson	19-21 West 44th street, New York, N. Y.
American Institute Horticultural Section	Leonard Barron	Do.
American Nurserymen's Protective Association	Thomas B. Meehan	Dreshertown, Pa.
American Pomological Society	John Craig	Ithaca, N. Y.
American Retail Nurserymen's Protective Association.	Guy A. Bryant	Princeton, Ill.
American Rose Society	Wm. J. Stewart	11 Hamilton place, Boston, Mass.
Cider and Cider-Vinegar Makers' Association of the Northwest.	George Miltenberger	[illegible] N. 2d street, St. Louis, Mo.
Chrysanthemum Society of America	David Fraser	Penn and Homewood ave., Pittsburg, Pa.
Eastern Nurserymen's Association	Wm. Pitkin	Rochester, N. Y.
International Apple Shippers' Association	A. Warren Patch	17 N. Market street, Boston, Mass.
Mississippi Valley Apple Growers' Association	James Handly	Quincy, Ill.
Missouri Valley Horticultural Society	A. V. Wilson	R. F. D., Muncie, Kans.
National League of Commission Merchants of the United States.	A. Warren Patch	17 N. Market street, Boston, Mass.
National Nut Growers' Association	J. F. Wilson	Poulan, Ga.
Northwestern Fruit Growers' Association	C. D. Huffman	Lagrande, Oreg.
Nurserymen's Mutual Protective Association	Geo. C. Seager	Rochester, N. Y.
Peninsula Horticultural Society	Wesley Webb	Dover, Del.
Society of American Florists and Ornamental Horticulturists.	Wm. J. Stewart	11 Hamilton place, Boston, Mass.
Southwestern Nurserymen's Association	J. A. Taylor	Wynnewood, Ind. T.
Western Association of Nurserymen	E. J. Holman	Leavenworth, Kans.

STATE HIGHWAY OFFICIALS.

State.	Name and title.	Post-office.
California	N. Ellery, commissioner department of highways	Sacramento.
Connecticut	James H. MacDonald, commissioner, State highway department.	Hartford.
Delaware	Francis A. Price, State highway commissioner for Newcastle County.	Wilmington.
District of Columbia.	C. B. Hunt, engineer of highways, District of Columbia	Washington.
Illinois	Dr. E. J. James, chairman	Springfield.
	A. N. Johnson, highway engineer, State highway commission.	Do.
Iowa	Prof. A. Marston, dean, division of engineering	Ames.
	T. H. McDonald, assistant in charge of public roads, State College.	Do.
Maine	Paul D. Sargent, commissioner of highways	Augusta.
Maryland	William Bullock Clark, State geologist	Baltimore.
	Walter W. Crosby, chief engineer highway division, geological survey.	Do.
Massachusetts	William E. McClintock, chairman	Boston.
	A. B. Fletcher, secretary State highway commission	Do.
Michigan	Horatio S. Earle, commissioner	Lansing.
	Frank F. Rogers, highway engineer, State highway department.	Do.
Minnesota	Gustave Scholle, president	Minneapolis.
	George W. Cooley, engineer, State highway commission	Do.
New Hampshire	Arthur W. Dean, State engineer, highway department	Concord.
New Jersey	Elisha C. Hutchinson, chairman	Trenton.
	R. A. Meeker, supervisor State commission of public roads	Do.
New York	Frederick Skene, State engineer and surveyor	Albany.
North Carolina	Samuel L. Patterson, chairman State highway commission	Raleigh.
Ohio	Sam Huston, commissioner State highway department	Columbus.
Pennsylvania	Joseph W. Hunter, State highway commissioner	Harrisburg.
	R. D. Beeman, assistant commissioner	Do.
Rhode Island	John H. Edwards, chairman State board of public works	Providence.
Vermont	Charles W. Gates, State highway commissioner	Montpelier.
Virginia	P. St. Julien Wilson, State highway commissioner	Richmond.
Washington	Joseph M. Snow, State highway commissioner	Olympia.

STATE OFFICIALS IN CHARGE OF PROTECTION OF GAME.[a]

Alabama	John H. Wallace, jr., State game commissioner	Montgomery.
Arizona	W. L. Pinney, secretary fish and game commission	Phoenix.
California	Chas. A. Vogelsang, chief deputy board of fish commissioners.	San Francisco.
Colorado	D. E. Farr, State game and fish commissioner	Denver.
Connecticut	E. Hart Geer, secretary commission of fisheries and game	Hadlyme.
Delaware	A. D. Poole, president Delaware Game Protective Association.	Wilmington.
Idaho	W. N. Stephens, fish and game warden	Boise.
Illinois	Dr. John A. Wheeler, State game commissioner	Springfield.
Indiana	Z. T. Sweeney, commissioner of fisheries and game	Columbus.
Iowa	G. A. Lincoln, State fish and game warden	Cedar Rapids.
Kansas	D. W. Travis, State fish and game warden	Pratt.
Maine	L. T. Carleton, chairman commissioners of inland fisheries and game.	Augusta.
Maryland	Oregon Milton Dennis, State game warden	Baltimore.
Massachusetts	Dr. George W. Field, chairman commissioners of fisheries and game.	Boston.
Michigan	Charles H. Chapman, game and fish warden	Sault Ste. Marie.
Minnesota	Carlos Avery, executive agent, board of game and fish commissioners.	St. Paul.
Missouri	Joseph H. Rodes, game and fish warden	Sedalia.
Montana	William F. Scott, State game and fish warden	Helena.
Nebraska	George L. Carter, chief deputy game and fish commission	Lincoln.
New Hampshire	Nathaniel Wentworth, chairman board of fish and game commissioners.	Hudson.
New Jersey	Benjamin P. Morris, president board of fish and game commissioners.	Long Branch.
New Mexico	W. E. Griffin, game and fish warden	Santa Fe.
New York	James S. Whipple, forest, fish, and game commissioner	Albany.
North Carolina	T. Gilbert Pearson, secretary Audubon Society	Greensboro.
North Dakota	W. N. Smith, game warden, district No. 1	Grafton.
	William McKean, game warden, district No. 2	Sanborn.
Ohio	George C. Blankner, secretary commissioners of fish and game.	Columbus.
Oklahoma	Eugene Watrous, Territorial game and fish warden	Enid.
Oregon	J. W. Baker, game and forestry warden	Cottage Grove.
Pennsylvania	Dr. Joseph Kalbfus, secretary board of game commissioners	Harrisburg.
Rhode Island	John H. Flanagan, chairman commissioners of birds	Providence.
South Carolina	B. F. Taylor, president Audubon Society	Columbia.

[a] Corrected to May 1, 1907.

State officials in charge of protection of game—Continued.

State.	Name and title.	Post-office.
Tennessee	Joseph H. Acklen, State warden	Nashville.
Texas	Game, fish, and oyster commissioner	Austin.
Utah	H. B. Cromar, State fish and game commissioner	Salt Lake City.
Vermont	Henry G. Thomas, fish and game commissioner	Stowe.
Washington	R. C. Bebee, chief deputy State game warden	Bellingham.
West Virginia	F. H. Merrick, chief deputy game and fish warden	Huntington.
Wisconsin	Jonas Swenholt, State warden	Madison.
Wyoming	D. C. Nowlin, State game warden	Lander.

ORGANIZATIONS FOR PROTECTION OF BIRDS AND GAME.

Name of organization.	Secretary.	Post-office.
American Ornithologists' Union, Committee on Protection of North American Birds.	A. K. Fisher, chairman.	Department of Agriculture, Washington, D. C.
Bird Protective Society of America	Edward C. Pease	28 Stafford Building, Buffalo, N. Y.
Boone and Crockett Club	Madison Grant	11 Wall street, New York, N. Y.
League of American Sportsmen	G. O. Shields, president.	1269 Broadway, New York, N. Y.
National Association of Audubon Societies	William Dutcher, president.	141 Broadway, New York, N. Y.
National Association of Game and Fish Wardens.	George L. Carter	Lincoln, Nebr.
New York Zoological Society	Madison Grant	11 Wall street, New York, N. Y.
North American Fish and Game Protective Association.	E. T. D. Chambers	Quebec, Canada.

AMERICAN BREEDERS' ASSOCIATION.

President, James Wilson, Washington, D. C.; vice-president, L. H. Kerrick,[a] Bloomington, Ill.; secretary, W. M. Hays, Washington, D. C.; treasurer, Oscar Erf, Manhattan, Kans.; chairman animal section, A. P. Grout, Winchester, Ill.; secretary animal section, C. B. Davenport, Cold Spring Harbor, N. Y.; chairman plant section, Chas. W. Ward, Queens, N. Y.; secretary plant section, N. E. Hansen, Brookings, S. Dak.

FARMERS' NATIONAL CONGRESS.

President, John M. Stahl, Chicago, Ill.; first vice-president, B. Cameron, Stagville, N. C.; second vice-president, Joshua Strange, Marion, Ind.; treasurer, W. L. Ames, Oregon, Wis.; secretary, George M. Whitaker, Washington, D. C.; first assistant secretary, Luther H. Tucker, Albany, N. Y.; second assistant secretary, John H. Kimball, Port Deposit, Md.; executive committee, president, secretary, and treasurer, E. W. Wickey, East Chicago, Ind.; Levi Morrison, Greenville, Pa.; A. C. Fuller, Dows, Iowa.

PATRONS OF HUSBANDRY.

OFFICERS OF NATIONAL GRANGE.

Master, N. J. Bachelder, Concord, N. H.; overseer, T. C. Atkeson, Morgantown, W. Va.; lecturer, G. W. F. Gaunt, Mullica Hill, N. J.; treasurer, Mrs. E. S. McDowell, Rome, N. Y.; secretary, C. M. Freeman, Tippecanoe City, Ohio; executive committee, E. B. Norris, Sodus, N. Y.; C. J. Bell, East Hardwick, Vt.; F. A. Derthick, Mantua, Ohio; N. J. Bachelder, ex officio, Concord, N. H.

[a] Deceased.

REVIEW OF WEATHER CONDITIONS DURING THE CROP SEASON OF 1906.

By JAMES BERRY, *Chief of Climatological Division, Weather Bureau.*

The accompanying illustrations (see figs. 17 to 19 and Plates XL to XLII) and tables (pp. 490 and 491) show how the temperature and rainfall over the United States during the crop season of 1906, from week to week, compare with the normal conditions of corresponding periods of former years. The diagrams exhibit the departure from normal by districts, and the maps show, respectively, the departures from normal temperature, the total precipitation, and the departures from normal precipitation during the crop season.

JANUARY.

January, 1906, was exceptionally mild over much the greater part of the country, the average temperature being above the normal in all districts, with the exception of the central portions of the middle and southern Plateau regions and extreme southern Florida, where it was slightly below, and in portions of the Gulf States, where it was about normal. The excess in temperature throughout the central and northern portions of the country was unusually marked, ranging from 6° to 13° per day. In the Missouri, upper Mississippi, and Red River of the North valleys, the Lake region, and southern New England the temperature excess generally was more than 9°. On the Pacific coast the temperature excess was slight, except in Washington and over the interior portions of central and northern California, where it was more than 3° per day.

The precipitation exceeded the average in the upper Mississippi, lower Missouri, and lower Arkansas valleys, the northern portion of the upper Lake region, the greater part of the South Atlantic States, the western portion of the central Plateau region, and in California, except in the vicinity of San Francisco and in the extreme southern part of the State. Over areas extending from western Arkansas to southern Illinois and from western Florida to southwestern Virginia the precipitation was unusually heavy, amounts ranging from 6 to more than 9 inches being reported from these districts. Generally throughout New England and the Middle Atlantic States, the lower Lake region, upper Ohio Valley, eastern Tennessee, in the central and west Gulf States, southern Plateau region, and on the north Pacific coast the precipitation was below the average, being decidedly deficient in New England and the lower Lake region and in portions of the central and west Gulf districts.

LITTLE SNOW ON THE GROUND.

At the close of the month the districts east of the Rocky Mountains were wholly free from snow, with the exception of a comparatively small area extending from the upper Missouri Valley eastward to Lake Huron, including a small part of the upper Mississippi Valley. There was practically no snow in New England, except in sheltered places in the northern portion.

FEBRUARY.

As a whole, February, 1906, averaged colder than usual in the Middle and South Atlantic and Gulf States, Ohio Valley, and portions of the lower Lake region and the upper Mississippi Valley. The deficiency in temperature was most marked in the upper Ohio Valley and in the central Gulf States, where it amounted to 6° per day. Generally throughout the South Atlantic and Gulf States and in the Ohio and central Mississippi valleys the deficiency amounted to more than 3° per day. Over the northern portion of the Lake region, along the New England coast, and over the southeastern Rocky Mountain slope the month averaged slightly milder than usual; it was decidedly milder than usual throughout the Rocky Mountain and Plateau regions and in the upper Missouri Valley, where the temperature excess ranged from 3° to 12° per day, being most marked in Montana.

From the 1st to the 3d the maximum temperatures on the central and southern California coasts equaled or exceeded the records of former years for the first decade of February; on the 19th and 20th unseasonably high maximum temperatures occurred in central Nebraska, the upper Michigan Peninsula, and in northern New England, and on the 23d and 24th the maximum records were broken at numerous stations in the lower Lake region, lower Ohio Valley, and New England.

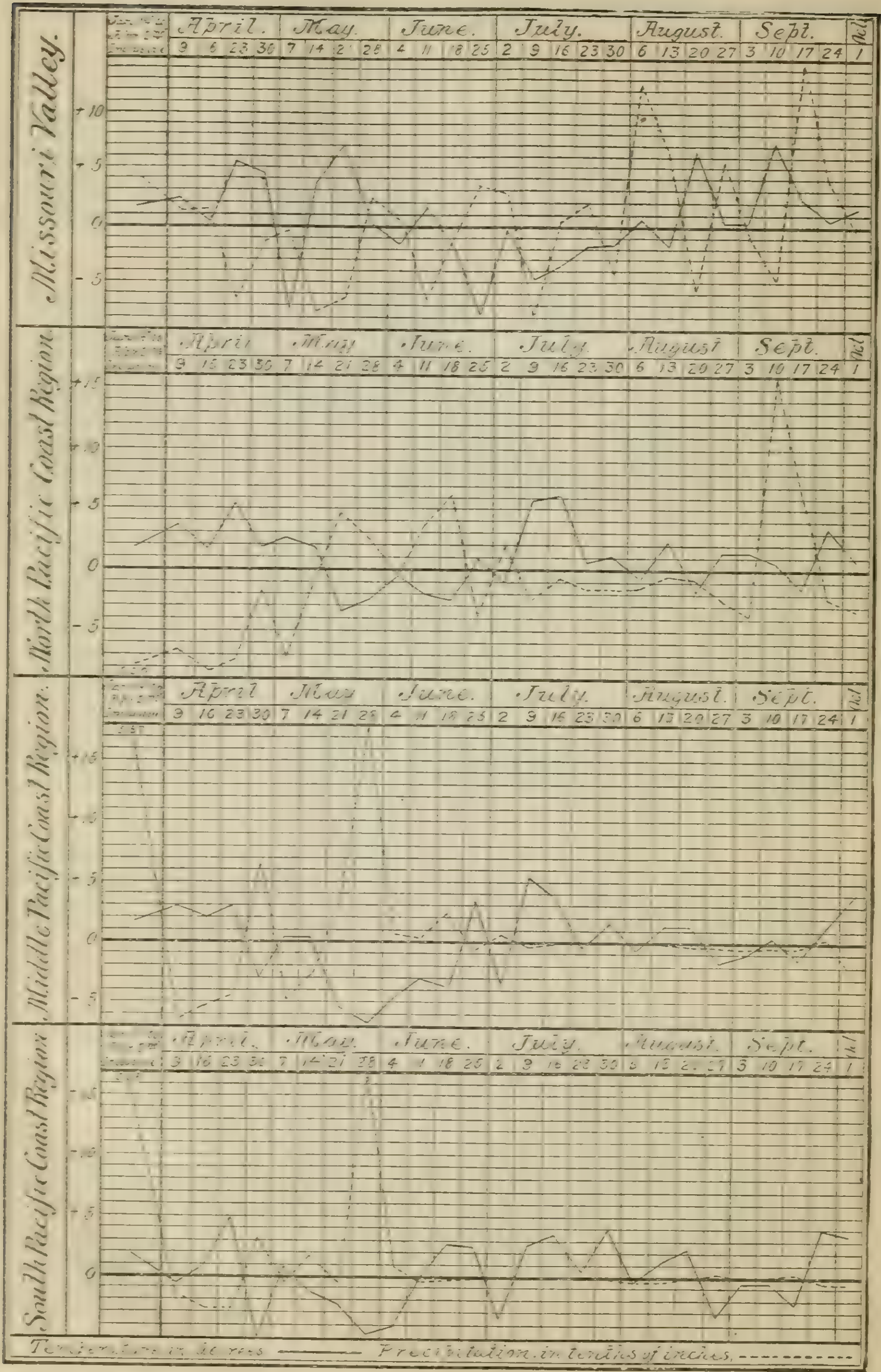


FIG. [illegible].—Temperature (degrees Fahrenheit) and precipitation (inches) departures for the season of [illegible] from the normal of many years in the Missouri Valley and the Pacific coast.

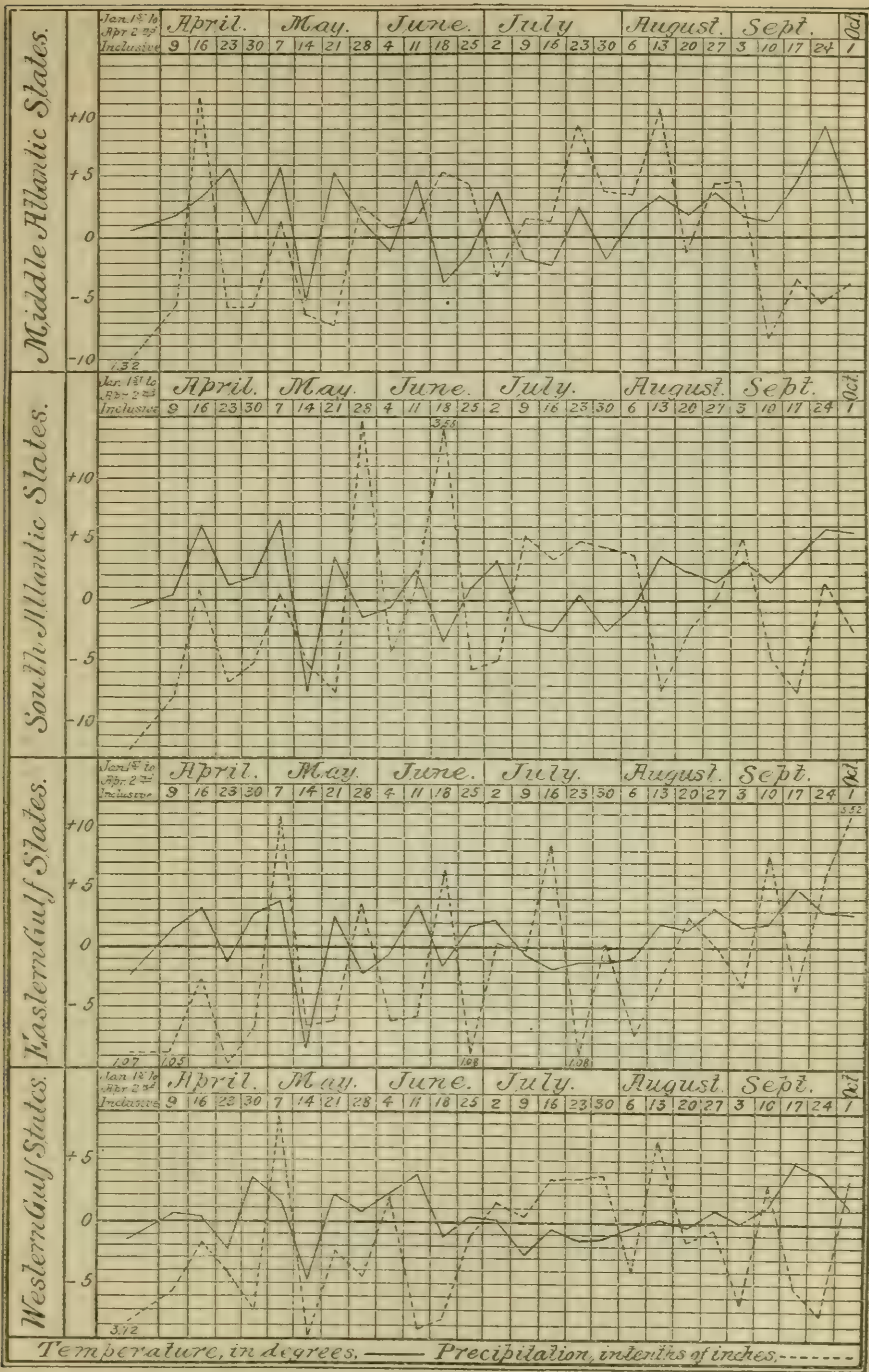


FIG. 18.—Temperature (degrees Fahrenheit) and precipitation (inches) departures for the season of 1906 from the normal of many years for the Middle and South Atlantic States and Gulf States.

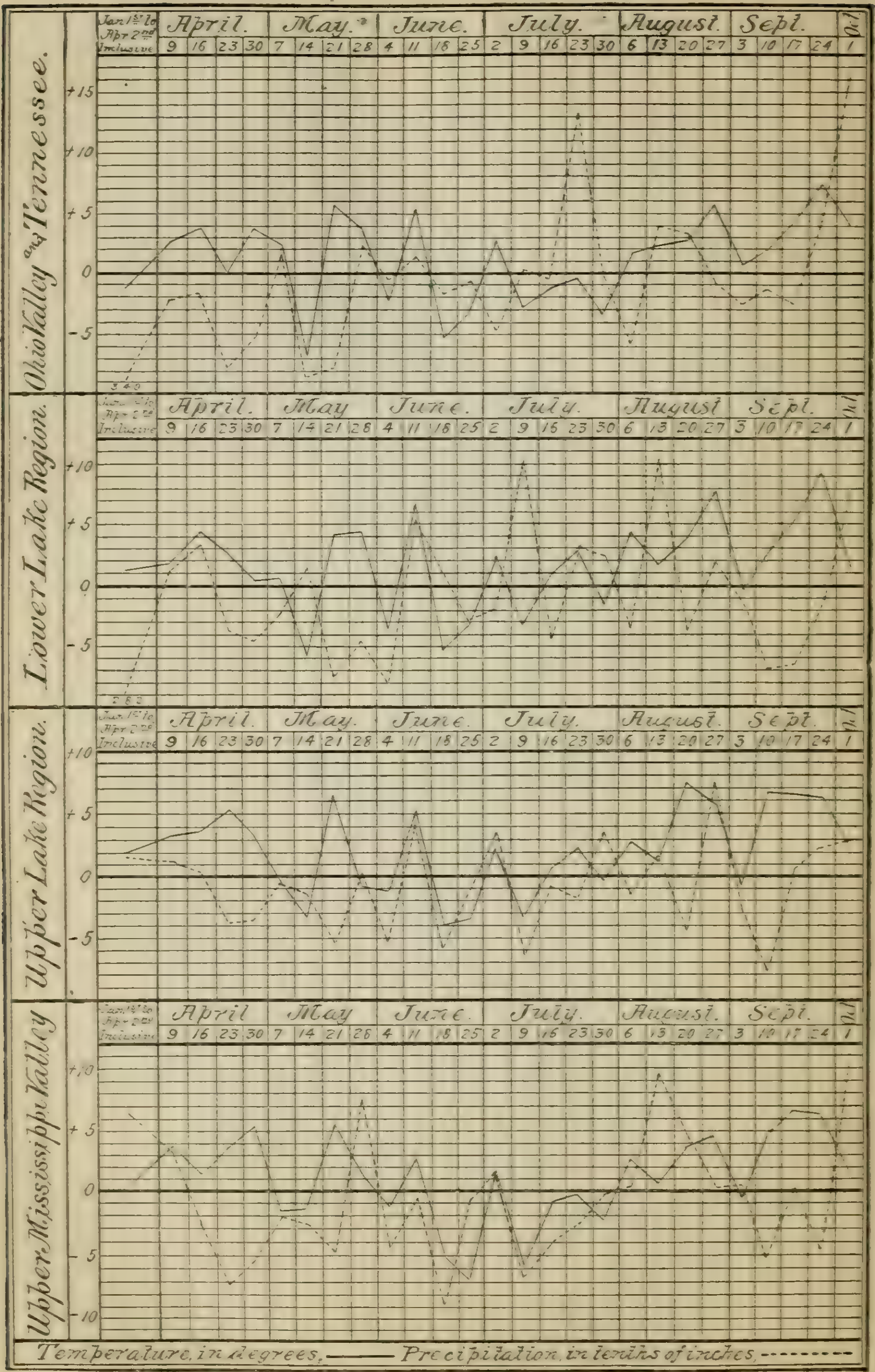
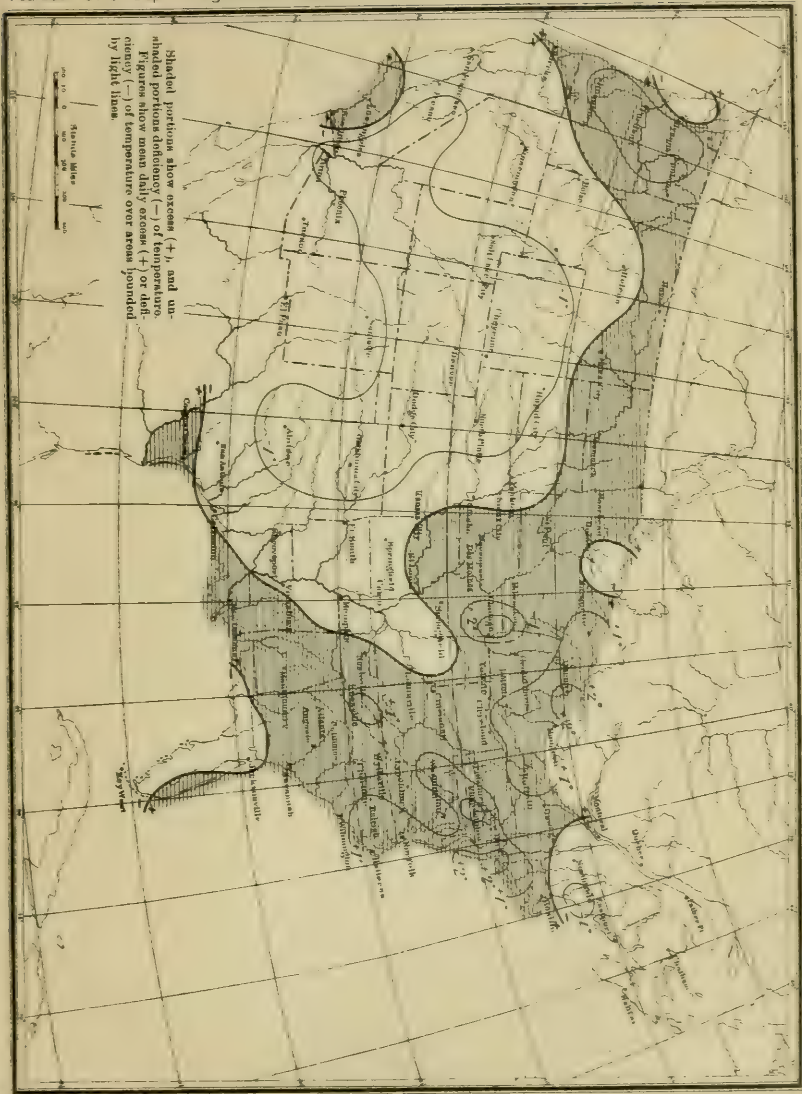
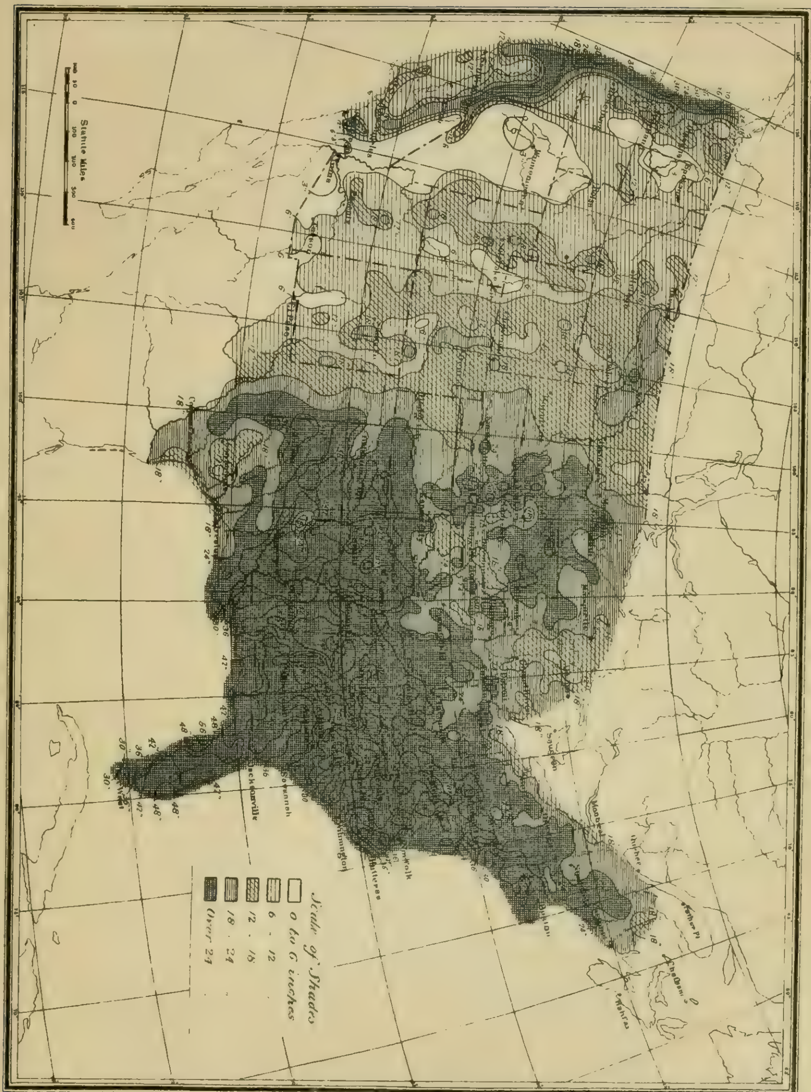


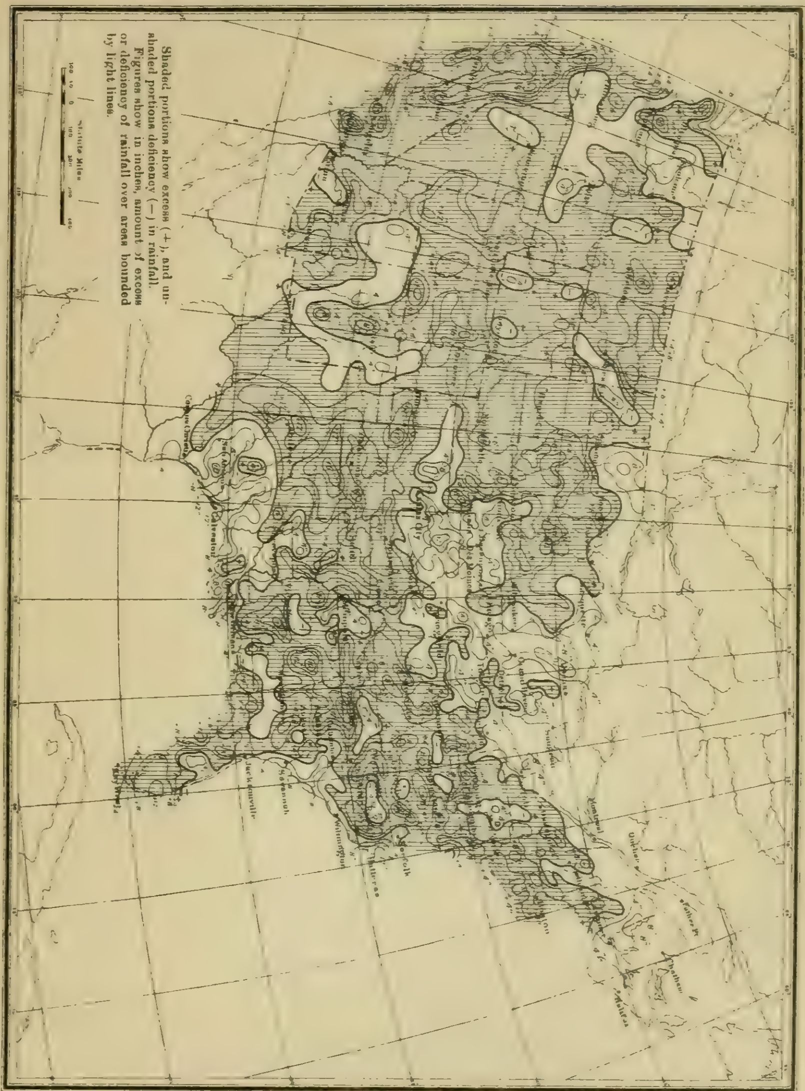
FIG. 19.—Temperature (degrees Fahrenheit) and precipitation (inches) departures for the season of 1906 from the normal of many years for the Lake region, the upper Mississippi Valley, the Ohio Valley, and Tennessee.



DEPARTURES FROM NORMAL TEMPERATURE FOR THE CROP SEASON OF 1906, FROM MARCH 1 TO SEPTEMBER 30.



TOTAL PRECIPITATION FOR THE CROP SEASON OF 1906, FROM MARCH 1 TO SEPTEMBER 30.



DEPARTURES FROM NORMAL PRECIPITATION FOR THE CROP SEASON OF 1906, FROM MARCH 1 TO SEPTEMBER 30.

COLD WAVES.

The first well-defined cold wave of the winter of 1905–6 advanced from Manitoba to the Atlantic coast States from the 1st to the 3d of February, with temperature 30° below zero at Winnipeg, Manitoba, on the 1st and 24° below zero at Sault Ste. Marie, Mich., on the 2d. On the morning of the 3d the temperature was below zero in the interior of New York and New England. The line of 10° was traced through the District of Columbia and southwestern Virginia and the line of freezing temperature through northwestern Florida. From the 3d to the 6th a cold wave advanced from the Rocky Mountains over the central valleys and the Middle Atlantic and New England States, carrying the line of zero temperature to Kansas, the Ohio River, and the interior of New York and New England. From the 13th to the 15th a cold wave swept from British America to the Atlantic and Gulf coasts, with zero temperature in the States of the lower Missouri Valley on the morning of the 14th and a fall in temperature of 20° to 30° in the interior of the Atlantic and east Gulf States by the morning of the 15th. A moderate cold wave overspread the central valleys and the eastern and southeastern States during the 26th, 27th, and 28th, attended by heavy snow from the middle Mississippi Valley over a great part of the Ohio Valley and in southern portions of the Middle Atlantic States, and by frost to the middle and east Gulf coasts and northern Florida.

Generally the precipitation was below the average, the month being exceptionally dry in the lower Lake region, Ohio Valley, and over the greater part of the interior of the Atlantic coast and Gulf districts. From the northern portion of the central Gulf States northeastward to the lower Lake region the deficiency in precipitation ranged from 2 to more than 4 inches, the most marked deficiency occurring in Tennessee and the adjacent portions of Arkansas, Mississippi, Alabama, Georgia, North Carolina, and Kentucky. Over a large part of the eastern Rocky Mountain slope and in the upper Missouri Valley the total precipitation for the month amounted to less than one-fourth of an inch and was decidedly below the average. In the lower Missouri Valley, portions of the central Mississippi Valley, along the immediate Atlantic coast from New Jersey to South Carolina, and in southern Florida, the precipitation exceeded the average, the excess being quite marked in eastern North Carolina, southern Florida, and portions of the central Missouri Valley. More than the average precipitation also occurred over the southern portions of New Mexico, Arizona, and California, in parts of central and northern California, and in western Oregon and southern Washington.

At the close of the month the area covered with snow was generally confined to the extreme northern districts, although portions of the central Mississippi and Ohio valleys and the Middle Atlantic States were covered to considerable depths. The amount of snow on the ground in northern New England was much less than usual at this time of the season.

MARCH.

The prominent features of March, 1906, were abnormally low mean temperature during the first and second decades, lack of sunshine, and generally excessive precipitation, although the latter was much below the average on the north Pacific coast and in portions of the west Gulf States, and portions of the Lake region and South Atlantic States received less than the average. Damaging freshets occurred in California and in portions of the northern Rocky Mountain region, upper Mississippi Valley, and east Gulf States. There was very general complaint of excessive cloudiness and moisture and of low temperatures in nearly all districts east of the Rocky Mountains.

The month averaged colder than usual throughout the country, with the exception of a comparatively small area embracing the southern portions of California, Arizona, and New Mexico and extreme western Texas, where the temperature was normal or slightly above. The month was decidedly cold in the middle and northern Rocky Mountain regions and eastward over the central valleys and the greater part of the Lake region and Atlantic coast and Gulf districts. The region in which the greatest deficiency occurred extends from Idaho southeastward over the middle Rocky Mountain slope and the lower Missouri, central Mississippi, and lower Ohio valleys, including the western portion of Tennessee and the northern portion of the central Gulf States, the average daily temperature in these districts ranging from 6° to 10° below the normal. Along the immediate coast from Florida to southern New England the temperature was generally below the normal, but the departures were not marked.

FROSTS AND LOW TEMPERATURES.

The cold wave of the closing days of February caused heavy frost in extreme northern Florida on the morning of March 1. From the 1st to 5th a moderate cold wave advanced from the British Northwest Territory to the east Gulf and South Atlantic

coasts, attended by zero temperature in the extreme Northwest, by falls in temperature of 10° to 20° in the central valleys and the Eastern States, and by heavy frost on the East Gulf coast and at Jacksonville. The second decade of the month was exceptionally cold, with heavy snow, from the middle and northern Plateau and Rocky Mountain regions over the States of the Missouri and upper Mississippi valleys and the northern Lake region. During this period temperatures 20° to 30° below zero occurred in the upper Missouri Valley; zero temperatures were reported from Wyoming, the middle Missouri Valley, Minnesota, and upper Michigan; and at the close of the decade the interior of Texas, the middle and east Gulf coasts, and extreme northern Florida were visited by heavy frost. From the 21st to 23d a moderate cold wave advanced from the British Northwest Territory eastward over the northern districts. No well-defined cold wave appeared after the 23d.

The total precipitation exceeded the average in the Middle Atlantic States, Ohio, upper Mississippi and Missouri valleys, middle Rocky Mountain slope, middle and southern Plateau region, California, and portions of the central and east Gulf States and Lake region. The monthly precipitation ranged from 6 to more than 12 inches in central and southern Mississippi, central Alabama, and northern Georgia, while the Ohio Valley and the greater part of the Middle Atlantic States and New England received from 4 to more than 6 inches. There was much less than the average precipitation in the greater part of Texas and over a narrow area extending thence to southwestern Virginia. On the Pacific coast the precipitation was abnormally heavy in California, the greater part of that State receiving from 4 to 12 inches, while Oregon and Washington received much less than the average.

At the close of the month very little snow remained on the ground in the districts east of the Rocky Mountains, except in the upper Michigan Peninsula along the shore of Lake Superior, where the depth ranged from 18 inches to more than 2 feet.

The Crop Season, April–September, Summary by Weeks.

By weeks, ending with Monday, from April 9 to October 1, the weather conditions may be summarized as follows:

April 9.—Although there was much cloudiness, generally favorable weather conditions prevailed, especially during the latter part of the week, in the central and northern districts east of the Rocky Mountains. There was, however, too much rain in portions of the Missouri and upper Mississippi valleys. In the southwestern districts, from Oklahoma and western Texas westward over the Plateau region, the week was cold and stormy. Frosts occurred as far south as the northern portions of the central and east Gulf districts.

This week averaged warmer than usual in the Lake region, central valleys, Middle Atlantic, and central Gulf States, and on the north and middle Pacific coasts. The excess in temperature ranged from 3° to 5° per day in the central valleys, the greater part of the Lake region, and along the immediate coasts of Washington, Oregon, and northern California, the most marked departures occurring in Minnesota and North Dakota. In northern New England and the Florida Peninsula, and over an area embracing the central and southern Plateau regions, southern California, the southeastern Rocky Mountain slope, and Texas the temperature averaged below the normal.

The precipitation was much above the average over the southern Plateau region, southeastern Rocky Mountain slope, the lower Missouri and upper Mississippi valleys, and over the greater part of the Lake region, amounts ranging from 1 inch to 2 inches being reported over the greater part of these districts. In the Atlantic and Gulf coast districts, the northern Plateau region, and on the Pacific coast the precipitation was below the average, only light showers occurring in the Middle Atlantic States and on the north Pacific coast, with practically no rain over a large part of the South Atlantic and east Gulf States, in central and northern California, and over much of the northern Plateau region.

SEVERE LOCAL STORMS.

April 16.—While this week averaged milder than usual throughout nearly the whole country, the latter part was decidedly cool, with light to heavy frosts on the 15th and 16th as far south as the northern portions of the Southern States. Complaints of too much rain were received from the Middle Atlantic States and portions of the Missouri Valley. The mild temperatures and generally light precipitation in the Southern States were favorable. In the Missouri and upper Mississippi valleys there was much sunshine, especially during the fore part of the week, while in the Middle Atlantic States the duration of sunshine was below the average.

Violent and destructive storms occurred on the 12th and 13th in portions of the Missouri, upper Mississippi, and Ohio valleys and west Gulf States.

The precipitation was very heavy in New England and the Middle Atlantic States, where amounts generally ranging from 1 inch to 4 inches were reported. Heavy rains also occurred in portions of the central Missouri and Red River of the North valleys, and more than the average fell over a large part of the Lake region, middle Rocky Mountain slope, and local areas in the South Atlantic States and Texas. In the Ohio Valley and portions of the upper Lake region and upper Mississippi Valley and generally throughout the Southern States and the Plateau and Pacific coast regions the precipitation was below the average, no appreciable amount being reported from western Texas, southwestern New Mexico, the southern portions of Arizona and California, northern California, the greater part of Oregon, eastern Washington, northern Idaho, and western Montana.

April 23.—During this week much the greater part of the country experienced very favorable temperatures, although some complaint of cool weather during a part of the week was received from portions of the west Gulf and Atlantic coast districts. There was ample sunshine, except in the central and west Gulf States, where much of the week was cloudy or partly cloudy. There was an absence of rain over a large part of the central valleys and east Gulf States and New England, with only light showers in the Lake region and Middle Atlantic States, while heavy rains occurred in Texas. The need of rain was beginning to be felt in Tennessee, Georgia, and Florida. Frosts were of general occurrence at the beginning or close of the week in the Lake region, Ohio Valley, and the interior portions of the Middle and South Atlantic States.

LOW TEMPERATURES; LOCAL DROUGHTS.

April 30.—While the temperature conditions to the eastward of the Rocky Mountains were generally favorable, there was much complaint of cold nights during the fore part of the week in the districts east of the Mississippi River, light frosts occurring as far south as the Carolinas and the northern portions of Georgia and Alabama, with heavy frosts and freezing temperatures in the higher portions of the more northerly districts. Over the middle and southern Plateau regions the temperatures were unseasonably low, especially during the middle of the week, when heavy frosts were general. The droughty conditions reported in the previous week in Tennessee and portions of the east Gulf States continued, the area needing rain being materially increased, at this time embracing North Carolina and a considerable part of the upper Mississippi and lower Ohio valleys. Severe local storms occurred in a number of the west Gulf States, and also in Tennessee and northern Georgia, from the 26th to the 28th. As a whole, there was ample sunshine.

May 7.—This week averaged warmer than usual in the middle and north Pacific coast districts and over the western portions of the middle and northern Plateau regions; it also averaged warmer than usual in the west Gulf States and in all districts east of the Mississippi River, with the exception of the upper Mississippi Valley, the western portion of the upper Lake region, and the interior of northern New England. In the middle and south Atlantic coast districts and in northern California, the temperature excess ranged from 6° to 9° per day, and it exceeded 3° per day in southern New England, the upper Ohio Valley, eastern Tennessee, and in the central and west Gulf districts and north Pacific coast region. In the southern Plateau region and over the eastern Rocky Mountain slope and the Missouri and upper Mississippi valleys the week averaged colder than usual, the deficiency in temperature being less than 3° per day over most of the area comprised by the districts mentioned, but ranging from 3° to 6° per day over the eastern Rocky Mountain slope and the upper Missouri Valley. Light to heavy frosts were general in the middle Rocky Mountain districts and throughout the Lake region and central valleys.

HEAVY RAINS IN PORTIONS OF THE COTTON BELT.

The rainfall was above the average over the greater part of the Southern States, being exceptionally heavy in the central and northern portions of Alabama and Mississippi and in Arkansas and northeastern Texas, where amounts ranging from 2 to more than 8 inches fell. Moderate to heavy rains occurred in eastern Nebraska, portions of northwestern Iowa, the central portions of Illinois and Indiana, the northern portions of Minnesota and Wisconsin, and at some stations in southern New England and the Middle Atlantic States. In the lower Missouri and upper Ohio valleys, the greater part of the Lake region, the eastern portion of the Carolinas, and the Florida Peninsula, along the immediate Gulf coast, in western Texas, and generally throughout the Plateau and Pacific coast regions, the precipitation was below the average, no appreciable amounts of rain falling in the southern Plateau and Pacific coast regions, except light showers in southeastern California. Excessively heavy rains proved damaging over

the northern portions of the central Gulf States. The droughty conditions in the previous week were very largely relieved. The greater part of Florida and portions of South Carolina and Missouri, however, continued to need rain. There was much cloudiness in the Lake region and in portions of the Gulf States. The weather conditions on the Pacific coast were favorable, except cool nights in Washington and Oregon.

UNUSUAL WARMTH IN THE UPPER MISSOURI VALLEY.

May 14.—This week averaged warmer than usual on the north Pacific coast, throughout the Plateau and Rocky Mountain regions, and in the Missouri and Red River of the North valleys. The average daily excess was most marked in the more northerly of these districts and ranged from 6° to 9° from the upper Missouri Valley westward to the eastern portions of Oregon and Washington and northern Nevada. On the southern California coast, in the west Gulf States, and in all districts east of the Mississippi River the week averaged cooler than usual, being abnormally cool in the lower Lake region, Ohio Valley, and the Middle and South Atlantic and east Gulf States, where the deficiency in temperature generally ranged from 6° to 11° per day, being most marked over the interior portions of the South Atlantic and east Gulf States and over the western portion of northern New England. Unusually high maximum temperatures occurred in the upper Missouri Valley on the 10th and 11th, when temperatures ranging from 90° to 96° were reported.

Freezing temperatures, or temperatures below freezing, occurred in the upper Missouri Valley, over the greater part of the Lake region, in the upper Ohio Valley, in the interior portions of the Middle Atlantic States, and in northern New England. Killing frosts were general from the 8th to the 11th throughout the central valleys and Atlantic coast districts, and light frosts occurred as far south as the interior portions of the central and east Gulf States.

DRY WEATHER PREVALENT.

The rainfall was below the average in nearly all districts east of the Rocky Mountains, the week being practically rainless over the greater part of the central and west Gulf States and in Tennessee and in portions of the lower Ohio and central Mississippi valleys. The northern portion of the upper Lake region and the interior portion of the Middle Atlantic States received only light showers, and in places no appreciable amount. There was more than the average over the southern portion of the upper Lake region and also in the middle Plateau region and portions of California. Showers, giving from one-fourth to 1 inch, occurred in the north Pacific coast region, but, as a whole, the precipitation in that region was below the average. The week was much drier than usual, being practically rainless in the central and west Gulf States, Tennessee, and in portions of the Middle Atlantic States, lower Ohio and central Mississippi valleys, in all of which districts rain was needed.

DECIDED TEMPERATURE EXTREMES.

May 21.—This week averaged cooler than usual in the central and northern Pacific coast districts and over the western portions of the middle and northern Plateau regions, the deficiency in temperature ranging from 3° to 8° per day over the interior portions of central and northern California and from 3° to 5° per day in western Nevada and in Oregon and the adjacent portions of Idaho and Washington. On the immediate west Gulf coast and in extreme southern Florida the week averaged slightly cooler than usual, but elsewhere east of the Rocky Mountains and over the southern Plateau region the week averaged warmer than usual, being decidedly warm over the middle Rocky Mountain slope and throughout the central valleys, Lake region, and Middle Atlantic States, where the average daily temperature excess generally ranged from 6° to 10°.

The maximum temperature records of former years for the second decade of May were exceeded at a number of stations in the upper Mississippi Valley on the 17th and 18th, and at some stations in southern New England and the Middle Atlantic States on the 18th and 19th. Freezing temperatures occurred in the middle Plateau and northern Rocky Mountain regions and in the extreme northern districts eastward of the upper Missouri Valley, and light to heavy frosts occurred in the Dakotas and Minnesota and generally throughout the Lake region and northern New England on the 19th and 20th.

As a whole, the week was drier than usual, a large part of the Atlantic coast and east Gulf States and portions of the central valleys and the Lake region receiving no appreciable amount of rain. There was also a general absence of rain in the southern Plateau and south Pacific coast regions. On the north Pacific coast the rainfall was

considerably above the average, more than an inch being reported from the coast districts of northern California, Oregon, and Washington. Heavy rains occurred in northern Texas and portions of Oklahoma and Indian Territory. Minnesota, eastern North Dakota, Montana, and portions of South Dakota, Iowa, and southern Florida received more than the average. A large part of the central valleys and Middle Atlantic States had now experienced a period of more than two weeks without appreciable rainfall, and droughty conditions, more or less serious, prevailed over practically the whole territory east of the Mississippi River and also in portions of the Missouri Valley and west Gulf States.

May 28.—On the Pacific coast and in the middle and northern Plateau and Rocky Mountain regions the week averaged much cooler than usual and the precipitation was exceptionally heavy for the season, especially in California, over the greater part of which State the weekly rainfall ranged from 1 inch to nearly 4 inches, the heaviest that had occurred during the last decade of May in more than twenty years. The week was also unseasonably cool and wet in the Dakotas, Minnesota, and Wisconsin, freezing temperatures occurring in the Red River of the North and upper Missouri valleys, with exceptionally heavy rains in southern Minnesota. In the lower Missouri, central Mississippi, and Ohio valleys, and in the lower Lake region and Middle Atlantic States the greater part of the week was much warmer than the average, but the last two days were unseasonably cool, and light frosts occurred in the central Missouri and upper Mississippi valleys and upper Lake region.

HEAVY RAINS ON THE PACIFIC COAST AND IN FLORIDA.

Throughout the Pacific coast and middle and northern Rocky Mountain regions and also in the upper Missouri, upper Mississippi, and Red River of the North valleys the rainfall was much above the average, and over the greater part of central and northern California it was unusually heavy for the season, ranging from 1 to nearly 4 inches. The total fall at San Francisco was 2.6 inches, which was the heaviest that had occurred at that place in the third decade of May since 1884. While portions of the central Mississippi and lower Ohio valleys and lower Lake region received very light rainfall, good rains fell over most of the country east of the Rocky Mountains. Depths ranging from 1 to more than 3 inches fell in New England, while southern Georgia and the greater part of Florida received from 2 to more than 4 inches, the total fall at Jacksonville, Fla., exceeding 13 inches. Portions of central and northern Texas also received more than the average, but in eastern Texas, Louisiana, Arkansas, and in portions of Missouri, southern Illinois, and the western portions of Kentucky and Tennessee the rainfall was very light. The drought conditions which had become severe in the preceding week were wholly or partially relieved over the greater part of the area affected. Drought continued, however, in portions of the central and west Gulf States, and in portions of the lower Missouri, central Mississippi, and lower Ohio valleys.

June 4.—The week ending June 4, 1906, as a whole, was unseasonably cold in the Plateau regions and over the greater part of California, and the fore part of the week was also unseasonably cold in the northern districts eastward of the Rocky Mountains and in the east Gulf States. Light to heavy frosts occurred in exposed places in the Lake region and upper Ohio Valley, and also in portions of the middle and northern Rocky Mountain and Plateau regions.

The rainfall was below the average over a large part of the Gulf States and throughout the Lake region, but was ample and generally well distributed in New England, the Middle Atlantic States, the lower Ohio and central Mississippi valleys, and over the northern portion of the west Gulf States. Throughout the northern Plateau region and the greater part of the northern and middle Pacific coast districts the rainfall was phenomenally heavy for the season, especially in Idaho and the eastern portions of Oregon and Washington.

LOCAL STORMS AND DROUGHT.

Damaging local storms occurred in portions of the New England and Middle Atlantic States on May 31 and June 1.

Drought continued in northern Missouri, extreme southern Illinois, southern Arkansas, and in portions of Florida, Louisiana, and Texas, being especially severe in the southeastern part of the last-named State.

June 11.—In the northern Rocky Mountain region, the middle and northern Plateau districts, and the northern and middle Pacific coast districts, the week ending at 8 a. m., June 11, 1906, averaged cooler than usual, and was the fourth consecutive week in which the temperature in these districts had been abnormally low. The deficiency

in temperature generally ranged from 3° to 9° per day over the middle and northern Plateau regions and the interior of northern California. Over the southeastern Rocky Mountain slope, the Missouri Valley, west Gulf States, and in all districts eastward of the Mississippi River, with the exception of extreme southern Florida, the week was warmer than usual, the temperature excess ranging from 3° to 9° per day over much the greater part of the districts named, the most marked departures occurring in the Lake region, Ohio Valley, and portions of the Middle Atlantic States.

Unseasonably high maximum temperatures occurred on the 9th and 10th in the west Gulf States, coast stations from New Orleans, La., to Corpus Christi, Tex., reporting temperatures equal to or exceeding the highest previously recorded in the first decade of June. Freezing temperatures occurred over limited areas in the Plateau region, where, however, the minimum temperatures for the most part ranged from 34° to 40°.

CONTINUATION OF DROUGHT IN LOCALITIES.

The greater part of Nebraska and Iowa and portions of northern Illinois, northwestern Missouri, and northern Virginia needed rain, and severe drought prevailed in southeastern Texas and in portions of the central Gulf districts, while eastern Kansas and portions of the upper Missouri Valley and upper Lake region suffered from heavy rains and freshets.

June 18.—This week averaged cooler than usual over the interior of northern California, on the north Pacific coast, and in nearly all districts east of the Rocky Mountains. The deficiency in temperature ranged from 3° to 6° per day over the greater part of the districts named, the most marked departures occurring in the upper Sacramento, central Mississippi, and lower Ohio valleys, the southern portion of the Lake region, and the interior portions of the Middle Atlantic States and New England. Over the eastern Rocky Mountain slope, southern Plateau region, and southern California, on the west Gulf coast, and in extreme eastern Maine, the week averaged slightly warmer than usual, the temperature excess over the greater part of these districts being less than 3° per day.

Very high maximum temperatures occurred in the Rio Grande Valley and the southern portions of New Mexico and Arizona, where the readings ranged from 100° to 110°. Unseasonably low minimum temperatures occurred on the 12th and 13th in the lower Lake region, upper Ohio Valley, northern portion of the Middle Atlantic States, and in New England, numerous stations reporting the lowest readings yet recorded in the second decade of June.

HEAVY RAINS IN THE ATLANTIC COAST DISTRICTS.

Generally throughout the Atlantic coast districts, including the upper Ohio Valley, eastern Tennessee, and the greater part of the east Gulf States, the rainfall was much above the average, exceptionally heavy rains having fallen in the Carolinas, Georgia, Florida, and eastern Alabama, in portions of which States rainfall ranging from 4 to more than 11 inches was reported. The western portions of Washington and Oregon, northern California, and a narrow area extending from western Kansas northward over the eastern portions of Nebraska and the Dakotas also received more than the average rainfall. From the west Gulf coast northward to the Lake region the precipitation was much below the average. Throughout the middle and southern Plateau regions and over a large part of Texas as well as over an area extending from Arkansas northward to Minnesota there was no appreciable rainfall.

Severe local storms, accompanied in places by hail, occurred in the lower Lake region and Middle Atlantic States during the latter part of the week.

COOL WEATHER IN THE INTERIOR DISTRICTS.

June 25.—The week ending at 8 a. m., June 25, 1906, averaged warmer than usual along the South Atlantic, Gulf, and Pacific coasts, in which districts the average daily temperature excess ranged from 1° to 5°, except in the lower Sacramento Valley, where it amounted to 7°. Over the extreme eastern portion of the lower Lake region the average daily temperature for the week was nearly normal. Elsewhere the week averaged cooler than usual, being decidedly cool on the northern New England coast and from the upper Ohio Valley westward to the central and northern Plateau regions. Throughout the central valleys and middle Rocky Mountain region the average daily temperature deficiency amounted to 6° or more, and in the northern Rocky Mountain region and the upper Missouri Valley it ranged from 9° to 12°, the most marked departures from the normal occurring in the Dakotas, Nebraska, Wyoming, and eastern Montana.

Unusually high maximum temperatures occurred in California and southern Arizona on the 18th. Freezing temperatures occurred in Wyoming, and minimum temperatures below 40° were reported from a large part of the Plateau region and from the northern portion of North Dakota. In the Middle Rocky Mountain region and central Missouri and central Mississippi valleys the minimum temperatures on the 20th, 21st, 24th, and 25th were unseasonably low, numerous stations reporting the lowest yet recorded in the last decade of June.

The rainfall was below the average over an area embracing the southern portion of the upper Lake region and the northern portions of Illinois, Indiana, and northwestern Ohio. The rainfall was also below the average on the southern New England coast and generally throughout the Southern States, although the eastern portion of the Carolinas, southern Florida, and scattered areas of limited extent in the central and west Gulf States received more than the average. Over a large part of the central and west Gulf States there was no appreciable rainfall, and similar conditions prevailed in the middle and southern Plateau and Pacific coast districts. Very heavy rains fell in the lower Missouri, central Mississippi, and Ohio valleys, Middle Atlantic States, and over the greater part of New England, from 2 to 4 inches being reported from the lower Missouri Valley and from 1 inch to more than 2 inches in the Ohio Valley and the Middle Atlantic States. Considerably more than the average rainfall occurred in the Red River of the North Valley and over the northern portion of the upper Lake region. The droughty conditions prevailing in the previous week in the upper Mississippi and lower Missouri valleys were largely relieved, but drought continues generally unbroken in Louisiana and southern and eastern Texas, while portions of northwestern Missouri and southern Mississippi and central and western Tennessee, Oklahoma, and western South Dakota needed rain.

Numerous local storms of considerable severity, in places accompanied by hail, occurred in the Ohio Valley and Middle Atlantic States during the latter part of the week.

July 2.—This week was warmer than usual in the Lake region, central valleys, Atlantic coast districts, and over the southeastern Rocky Mountain slope. The average daily temperature excess was most marked over an area extending from the middle Atlantic coast westward to the central Mississippi Valley, including a part of the upper Lake region, where it ranged from 3° to 6°. The temperature averaged nearly normal in the west Gulf States and on the northern California coast. The week was cooler than usual on the north Pacific coast, over the greater part of California, throughout the Plateau and Rocky Mountain regions, and in the upper Missouri Valley. The average daily deficiency in temperature amounted to 3° or more over the greater part of the Plateau regions and exceeded 6° in portions of California, Nevada, Utah, Wyoming, and Montana.

The rainfall exceeded the average in the lower Missouri, upper Mississippi, and Red River of the North valleys, southern New England, Louisiana, and eastern Texas, and over limited areas in the South Atlantic and east Gulf States. Portions of Kansas, Nebraska, Iowa, northern Illinois, South Carolina, Louisiana, and Texas received amounts ranging from 2 to more than 4 inches. There was also more than the average precipitation on the extreme north Pacific coast and over a considerable part of the northern Plateau region. Over most of the Middle and South Atlantic and east Gulf States, and in the Ohio and central Mississippi valleys, and central portion of the Lake region the rainfall was below the average, no appreciable amount having fallen in southern Florida, eastern Kentucky, and in portions of southern Illinois.

LOCAL DROUGHT RELIEVED.

The prolonged drought in Texas, Louisiana, and northwestern Missouri was largely relieved. There was now sufficient moisture for present needs in all districts east of the Rocky Mountains, with the exception of southern Florida, Tennessee, and portions of the Ohio Valley, and apparently no section was suffering as a result of heavy precipitation.

While local storms, in places accompanied by hail, occurred during the latter part of the week in the Missouri and upper Mississippi valleys, Lake region, and Middle Atlantic States, they were not unusually destructive.

July 9.—The week ending July 9 was abnormally cool in the middle and southern Rocky Mountain regions and throughout the central valleys, Lake region, and greater part of the middle Atlantic coast districts. Very general complaints of cool nights were received from the central valleys, west Gulf States, and southern Rocky Mountain region, and while the temperature conditions were not conducive to rapid growth of vegetation, they were especially favorable for harvesting. On the north Pacific coast the week was exceptionally hot and dry.

HIGH TEMPERATURES IN THE PACIFIC COAST REGIONS.

July 16.—In the Lake region and upper Ohio Valley and on the west Gulf coast the temperature averaged slightly above the normal. Elsewhere east of the Rocky Mountains the week averaged cooler than usual, the deficiency in temperature over the eastern Rocky Mountain slope, lower Missouri Valley, and the interior portions of the central and east Gulf States generally ranging from 3° to 6° per day, the most marked departures occurring over the middle Rocky Mountain slope. Over the western portions of the Plateau districts and in the Pacific coast States, except along the central California coast, the week averaged warmer than usual, being decidedly warm over the interior of central and northern California and in Washington and Oregon, where the temperature excess ranged from 3° to 12° per day.

Unusually high maximum temperatures occurred in the middle and north Pacific coast regions, readings ranging from 100° to 108° occurring in central and northern California, and from 100° to 104° in portions of Oregon and Washington. At Roseburg, Oreg., the maximum of 102° on the 12th was 2° higher than any maximum previously recorded at that station in the second decade of July. The minimum temperatures on the morning of the 16th in the upper Mississippi Valley were unusually low, 52° at Des Moines, Iowa, corresponding to the lowest minimum temperature previously recorded at that station in the second decade of July.

HEAVY RAINS IN THE GULF STATES.

Over most of the Gulf States the rainfall exceeded the average and in many places was excessively heavy, although scattered areas received less than the average. Northern Florida and portions of Georgia, Alabama, Louisiana, and Texas received amounts ranging from 2 to more than 6 inches, the heaviest occurring in northern Florida, where a fall of more than 8 inches was reported. The Middle Atlantic States and portions of the Mississippi and Central Missouri valleys and upper Lake region also received more than the average precipitation, but, as a whole, there was less than the average in the central valleys, Lake region, and northern portion of the Middle Atlantic States. Light showers, giving from 0.1 to 0.5 inch, occurred on the north Pacific coast and over the southern Plateau region.

Droughty conditions existed to a considerable extent in the southern portion of the upper Lake region, in parts of the lower Missouri and central Mississippi valleys, and in the northern portion of the Middle Atlantic States.

As in the preceding week, local storms were comparatively few and caused very little damage.

July 23.—Generally throughout the Plateau districts and in the Lake region, New England, and the Middle Atlantic States, the temperature during this week was above the normal, the excess ranging from 3° to 6° per day in the northern Plateau region and from 2° to 4° in the Lake region, New England, and the northern portion of the Middle Atlantic States. In the lower Missouri, central Mississippi, and Ohio valleys and the South Atlantic States, and on the Pacific coast, the temperature was nearly normal. In the central Missouri Valley and the central and west Gulf States the week was cooler than usual, the average daily deficiency generally ranging from 1° to 5°.

In the Middle Atlantic States, Ohio Valley, and Tennessee, and over the greater part of the Gulf States, the precipitation during the week was in excess of the average, being unusually heavy in portions of the Middle and South Atlantic and Gulf States. Kansas, eastern Nebraska, and portions of the Lake region and upper Mississippi Valley also received more than the average rainfall, but over the greater part of the Lake region and upper Mississippi Valley there was less than the average.

DROUGHT IN PORTIONS OF THE CORN BELT.

Northeastern Missouri and portions of Iowa, Illinois, Indiana, and the Dakotas needed rain, drought being quite severe in northeastern Missouri and the central-western counties of Illinois, but elsewhere in the principal agricultural States there was ample moisture, heavy rains having occurred from the central and west Gulf coasts northeastward to the lower Lake region, in the Middle and South Atlantic States, and in southwestern Missouri and central Kansas.

Damaging local storms attended the heavy rainfall in the South Atlantic and east Gulf States, and hailstorms caused considerable damage in Kansas.

The general weather conditions on the Pacific coast were favorable, although very high temperatures occurred in central and northern California, western Idaho, and the eastern portions of Oregon and Washington.

July 30.—Throughout the central valleys and Atlantic coast districts and over the greater part of the Lake region and Gulf States this week averaged cooler than usual,

the mean temperature being considerably below the normal in the central valleys and over the northern part of the middle and west Gulf districts. In the Rocky Mountain and Plateau regions and in the Pacific States, except on the immediate coast, the week was hot and generally dry.

East of the Rocky Mountains both the maximum and minimum temperatures were lower than usual, the maximum not exceeding 80° at some stations in the Lake region and on the New England and middle Atlantic coasts, and being below 90° elsewhere, except in the Gulf States and at a few stations in the central Mississippi and Missouri valleys, where they ranged from 90° to 98°. Some high maximum readings, ranging from 100° to 112°, were reported from the northern and southern Plateau regions and from the interior of central and northern California, the highest occurring at Phoenix, Ariz., where the previous maximum record for the last decade of July was exceeded by 1°.

DROUGHT IN CENTRAL VALLEYS; TOO MUCH RAIN IN GULF STATES.

Much of the South Atlantic and east Gulf States and portions of the central and west Gulf States suffered to some extent from heavy rains, while moisture was generally needed in the upper Missouri Valley and over a considerable part of the lower Missouri, central Mississippi, and Ohio valleys, drought being serious in the greater part of northern Missouri. The area now affected by drought in the central valleys was less than in the previous week, but in the upper Missouri Valley the area needing rain apparently was greater.

A few severe local storms occurred, mostly in the South Atlantic States and upper Missouri Valley, but as a whole the week was comparatively free from storms of this class.

TEMPERATURE CONDITIONS FAVORABLE.

August 6.—During the week ending August 6 the temperature averaged much above the normal in the central valleys, Lake region, and Middle Atlantic States, in which districts the preceding week for the most part was decidedly cool, while the temperature was generally deficient in the Rocky Mountain and Pacific coast districts, where in the preceding week it was mostly above the normal. Generally the temperature conditions throughout the country were favorable.

The Atlantic coast districts, with the exception of northern New England, suffered from excessive moisture, while portions of the lower Missouri, central Mississippi, and Ohio valleys continued in need of rain, drought being very severe in portions of Missouri, Illinois, and Indiana. Drought was also prevalent on the north Pacific coast, and forest fires were burning in Oregon.

The week was comparatively free from local storms.

Light frost occurred on July 31 and August 1 in the upper Michigan Peninsula.

DROUGHT LARGELY RELIEVED IN CENTRAL VALLEYS.

August 13.—Except in the northern Plateau and north Pacific coast regions, where the week was very hot, the temperature conditions were very favorable.

The droughty conditions prevailing in portions of the lower Missouri, central Mississippi, and Ohio valleys in the preceding week were relieved, except in northwestern Missouri. Parts of the South Atlantic and east Gulf States and scattered localities in Tennessee were beginning to need rain, while dry weather and sunshine would have proved beneficial in the Middle Atlantic States, Ohio Valley, and portions of Texas. Portions of the lower Missouri and upper Mississippi valleys, upper Lake region, and Middle Atlantic States suffered from excessive rains. Droughty conditions in Washington were relieved in part, but in Oregon drought continued, only light showers having occurred in northeastern counties.

Notwithstanding the heavy rainfall over a large part of the country, the week was comparatively free from storms of a damaging character.

HIGH TEMPERATURES PREVALENT.

August 20.—The States of the Missouri Valley and the northern Rocky Mountain region experienced the warmest weather of the season during this week, and the mean temperature was decidedly above the normal throughout the central valleys and Lake region. Very high maximum temperatures, ranging from 95° to more than 100°, occurred in the upper Missouri Valley, some damage having been done by hot winds in North Dakota. From the west Gulf coast to southeastern California and on the north Pacific coast the week averaged somewhat cooler than usual.

Light frost occurred in elevated districts in Utah, also in Maine and New Hampshire on the morning of the 16th, and minimum temperatures nearly low enough for frost were reported from the higher districts in the eastern and northern portions of New York.

The Missouri Valley, the lower Lake region, New England, the northern part of the Middle Atlantic States, and the greater part of the Gulf States and upper Lake region received less than the average rainfall during the week, no appreciable amount having occurred over the northern part of the Middle Atlantic States and southern New England. There was also a general absence of rain over a large area extending from western Texas northward to eastern South Dakota. Heavy rains occurred in Virginia, North Carolina, portions of South Carolina, the interior of the central and east Gulf States, Ohio Valley, and portions of the upper Mississippi Valley, in which districts amounts ranging from 1 inch to more than 4 inches fell. The Plateau regions, especially the central and southern, received much more than the usual rainfall, nearly 2 inches being reported from Yuma, Ariz. There was no appreciable rainfall on the Pacific coast, except in extreme northwest Washington.

The central Missouri Valley, northern New England, a large part of the Lake region, and local areas in the east Gulf States needed rain; elsewhere east of the Rocky Mountains there was sufficient moisture, portions of North Carolina having suffered from excessive rains. Rain was badly needed on the north Pacific coast.

Local storms of considerable severity occurred in the Ohio and upper Mississippi valleys.

August 27.—This week was cooler than usual in the valleys of the Red River of the North and the upper Missouri, throughout the Rocky Mountain and Plateau regions, and in California, and there was a slight deficiency in temperature in portions of Oklahoma and north central Texas and over the greater part of the Florida Peninsula. Generally throughout the Plateau and Rocky Mountain regions and in the upper Missouri Valley the average daily temperature deficiency ranged from 3° to more than 9°, the most marked departures occurring over portions of Montana and Idaho. Over the western portions of Oregon and Washington the temperature averaged slightly above the normal. From the lower Missouri Valley southward to the west Gulf coast and in the districts east of the Mississippi River, with the exception of Florida, the week was warmer than usual, being decidedly warm in the upper Mississippi and Ohio valleys and Lake region and over the interior portions of the Middle Atlantic States and New England, where the average daily temperature excess ranged from 6° to 9°.

UNUSUALLY HEAVY RAINS IN MONTANA, UTAH, AND NEW MEXICO.

During the week there was less than the average precipitation in New England, the lower Lake region, portions of the upper Lake region and upper Mississippi and central Missouri valleys, and over a large part of the central and west Gulf States, although limited areas in all these districts received good rains, the average amount falling in some places. There was also less than the average rainfall in the upper Ohio Valley, the eastern portions of Kentucky and Tennessee, the western portions of Virginia and North Carolina, and on the north Pacific coast. The Middle and South Atlantic States, lower Ohio and central Mississippi valleys, lower and upper portions of the Missouri Valley, and the northern portion of the west Gulf States received more than the average rainfall, very heavy rains having fallen in portions of the Middle and South Atlantic States, lower Missouri Valley, and in portions of South Dakota, Kansas, Missouri, and Arkansas. There was also more than the average precipitation throughout the States of the eastern Rocky Mountain slope and in the middle and northern Plateau regions, more than an inch of rain being reported from portions of Utah, New Mexico, and western Montana, where such rainfalls are very unusual. Dry weather continued on the north Pacific coast, where rain was also much needed. Rainfalls unusually heavy for that region, ranging from one-half inch to more than an inch, occurred over a large part of the Plateau districts.

TOO MUCH RAIN IN MIDDLE ATLANTIC STATES.

September 3.—While the fore part of this week was unseasonably cool in the central valleys and Lake region, as a whole the temperature conditions in the districts east of the Rocky Mountains were favorable. Light frosts occurred in the Dakotas and Minnesota, upper Michigan, and northern New England. Over the southern Plateau region the temperature averaged unusually low, and light to heavy frosts occurred in Utah and Arizona.

Excessive moisture proved unfavorable in the Middle Atlantic States, while the central Gulf States and parts of the Missouri Valley and New England needed rain. Elsewhere east of the Rocky Mountains the rains were generally well distributed, ample, and not harmful. Little or no rain fell on the Pacific coast and drought continued in Washington and Oregon.

The week was almost wholly free from local storms of severity.

UNUSUAL WARMTH THROUGHOUT THE COUNTRY

September 10.—Throughout nearly the whole country the week ending September 10 was unusually warm, the mean temperature ranging from 6° to more than 12° above the normal from the Lake region westward to Idaho. In California, southwestern Texas, and northern New England the week averaged slightly cooler than usual. Light frosts occurred during the fore part of the week in parts of the upper Lake region and northern New England, and during the latter part of the week in the southern Plateau region, eastern Oregon, and Idaho.

NEEDED RAINS ON NORTH PACIFIC COAST.

The week was practically rainless in most of the northern districts east of the Rocky Mountains and also over the middle and southern Plateau regions and in California. Heavy rains occurred in Texas, Tennessee, portions of the east Gulf States, and over limited areas in Missouri, Arkansas, and eastern North Carolina, causing local damage in portions of Texas and Alabama. Rain was much needed in northern New England, portions of the Lake region and upper Mississippi Valley, and in the northern Rocky Mountain region. Good rains terminated the drought in western Washington and showers afforded needed relief in Oregon.

September 17.—This week was abnormally cool in the Plateau and Rocky Mountain regions, but in the districts to the eastward it averaged much warmer than usual, although cool during the latter part in the more northerly districts. Light frosts occurred on the 13th and 14th in the Dakotas, Minnesota, and upper Lake region, and on the 15th at a few places in the lower Lake region and northern New England. Freezing temperatures occurred over a large part of the Plateau and northern Rocky Mountain regions.

Parts of New England, the Lake region, Ohio Valley, Tennessee, and central and east Gulf States needed rain; elsewhere the rainfall was generally ample. Good rains fell on the north Pacific coast and generally throughout the Plateau and Rocky Mountain regions, and very heavy rains occurred in Oklahoma, western Kansas, Nebraska, eastern South Dakota, southern Minnesota, and western Iowa.

September 24.—Over most of the country this week averaged warmer than usual, the temperature excess being very decided in the districts east of the Mississippi River and from Minnesota westward to the north Pacific coast. The week was somewhat cooler than usual from the central Missouri Valley westward over the middle Rocky Mountain region, including the northern portion of the southern Plateau region. No freezing temperatures were reported from stations within the United States, the lowest, 34°, being reported from the Yellowstone National Park, Wyo., and Northfield, Vt., and no frost occurred in the districts east of the Rocky Mountains, but light to heavy frosts occurred in the higher portions of Nevada, Utah, Arizona, and New Mexico.

Heavy rains occurred in the east Gulf States, in portions of the Carolinas, Tennessee, and Kentucky, in southern New England, and over an area extending from Oklahoma northward to eastern South Dakota. In these districts amounts ranging from 1 inch to more than 3 inches are reported. There was more than the average over local areas in the Lake region and central and west Gulf States. In the Middle Atlantic States and Florida and generally throughout the Lake region, central valleys, and west Gulf districts, the rainfall was below the average, areas of considerable extent in Texas and the central Mississippi Valley receiving no appreciable amount. There was a general absence of rain throughout the Plateau regions and in southern California. Light showers giving from one-fourth to one-half inch occurred in the middle and northern Pacific coast districts.

DAMAGE BY HIGH WINDS.

On the 17th the Carolinas suffered considerably from the high winds accompanying the tropical storm off the south Atlantic coast on that date, and heavy rains and high winds in Minnesota on the 20th caused much damage.

DAMAGING STORM IN CENTRAL AND EAST GULF DISTRICTS.

October 1.—During this week the rainfall was very heavy from the central and east Gulf coasts northward to the upper Mississippi Valley and upper Lake region, over which region the total rainfall accompanying the tropical storm on the 27th and 28th generally ranged from 2 to more than 8 inches, nearly 14 inches having fallen at Pensacola. The central and east Gulf districts sustained severe losses as a result of high winds and excessive rains accompanying this storm.

The temperature conditions were generally favorable, being above the normal over nearly the whole country. Freezing temperatures occurred, however, in portions of the Rocky Mountain and upper Lake regions and in northern New England, with light to heavy, but generally harmless, frosts in the northern districts from the Missouri Valley eastward during the latter part of the week.

REVIEW OF THE SEASON.

The season from March 1 to October 1, 1906 (215 days), closed with a decided shortage in precipitation in the central valleys and west Gulf States and over a large part of the Lake region and south Atlantic coast districts. A marked deficiency also existed on the north Pacific coast. In California and generally throughout the Plateau and Rocky Mountain regions the seasonal precipitation was much above the normal. An excess was also shown over the interior portions of the south Atlantic and east Gulf districts and on the middle Atlantic coast.

For the period from March 1 to this time the seasonal temperature was above the normal over the greater part of the country east of the Mississippi River, the high mean temperatures during the last six weeks having overcome the seasonal deficiency existing over a large part of this region in the earlier part of the summer. The average daily excess was most marked in the upper Lake region and on the southern New England and middle Atlantic coasts, where it ranged from 1° to 2° per day. The seasonal temperature was also in excess of the normal on the north Pacific coast, on the immediate coast of extreme southern California, and in the upper Missouri Valley. It was below the normal in central and northern California and throughout the middle and southern Plateau and Rocky Mountain regions, the departures ranging from 1° to 2° over the middle Rocky Mountain slope and middle Plateau region.

OCTOBER.

The mean temperature for this month was below the normal over most of the country from the southeastern Rocky Mountain slope to the south Atlantic coast, the deficiency being most marked in the Gulf States, where it generally ranged from 3° to 5° per day. A slight deficiency was also shown over the Ohio and lower Missouri valleys, the western portion of the upper Lake region, and northern New England. Over the greater part of the Lake region, however, and in the upper Mississippi and Middle Atlantic States the mean temperature differed but slightly from the normal. In eastern North Carolina, southern Florida, and the upper Missouri Valley, and generally throughout the Plateau and Pacific coast regions the mean temperature was above the normal, the average daily excess ranging from 3° to 5° over the northern Plateau and the greater part of California.

The lowest minimum temperature, 6°, occurred at Devils Lake, N. Dak., and the next lowest, 8°, at Flagstaff, Ariz. In the Plateau region, upper Missouri Valley, and western portion of the upper Lake region the minimum temperatures generally ranged from 12° to 20°; in the lower Missouri, upper Mississippi, and Ohio valleys and the greater part of the Lake region and New England, from 20° to 30°; over the northern portion of the Southern States, from 30° to 40°; and along the south Atlantic and Gulf coasts, from 40° to 50°, except in extreme southern Florida and on the west Gulf coast, where they were above 50°. Freezing temperatures extended as far south as the western portion of southern Texas and the northern portions of Alabama and Georgia.

The precipitation during October exceeded the normal over the middle Rocky Mountain slope, central Missouri Valley, and the greater part of the central Gulf States, and also in the lower Lake region, Middle Atlantic States, and portions of the South Atlantic States and New England. The total fall was heaviest on the west Gulf coast, where it ranged from 6 to 10 inches, while amounts ranging from 4 to more than 7 inches were reported from portions of the lower Lake region, Middle Atlantic States, and southern New England. In the lower Missouri, upper Mississippi, and Ohio valleys, in Florida, and in portions of New England and the South Atlantic States, there was less than the normal precipitation, the deficiency being marked in the lower Missouri and upper Mississippi valleys and in Florida. There was more than the usual amount in portions of western Washington, but elsewhere on the Pacific coast there was a marked deficiency, as compared with the October normal.

HEAVY SNOW IN COLORADO AND WYOMING.

From the 19th to the 23d a severe storm prevailed in the Rocky Mountain region, the snowfall in Colorado and Wyoming being exceptionally heavy.

November.

While the weather was unusually dry in California, the north Pacific coast experienced unusually stormy weather during the greater part of the first half of the month, the heavy rains causing damaging freshets in Oregon and Washington. Another marked feature of the month's weather was the stormy period from the 19th to the 21st in the Mississippi and Ohio valleys, very heavy rains occurring in eastern Arkansas, northern Mississippi, the western portions of Tennessee and Kentucky, and the southern portions of Indiana and Illinois. In the Atlantic coast and east Gulf districts weather conditions were mild, with much less than the usual rainfall.

The mean temperature was above the normal over most of the country east of the Rocky Mountains, the average daily excess being less than 3° per day, except over portions of the upper Lake region and Middle Atlantic and central Gulf States, where it ranged from 3° to 5° per day. In Tennessee and portions of the central Mississippi and lower Missouri valleys and in the middle Rocky Mountain region and northern California the mean temperature was nearly normal. Generally throughout the Plateau regions and in southern California the month averaged colder than usual, the deficiency in temperature ranging from 3° to 4° per day over an area covering portions of California, Nevada, and Utah, and in portions of eastern Oregon and Washington.

The precipitation during this month was much below the average in the Atlantic coast and Gulf districts, except in extreme southern Florida and on the southern Texas coast, where it was much above the average. The total amount in the coast districts from southern New England to central Florida was generally less than 2 inches, and over a large part of this regio.. there was less than 1 inch, making the deficiency range from 1 inch to more than 2 in.hes. There was also less than the usual rainfall in the lower Lake region and upper Ohio Valley, over portions of the central Missouri Valley, and in Oklahoma and California. The precipitation was excessively heavy in the lower Ohio and central Mississippi valleys, where it ranged from 6 to 18 inches, the largest amounts being reported from eastern Arkansas, northern Mississippi, and western Tennessee. Generally throughout the Plateau and north Pacific coast regions the precipitation exceeded the average, a large excess being indicated over the southern Rocky Mountain region and the greater part of Oregon and Washington.

At the close of the month the upper Michigan Peninsula and portions of northern Minnesota, North Dakota, and Montana were covered with snow ranging in depth from 1 inch to 11 inches. Stations in portions of Nevada and Utah reported depths at the close of the month ranging from 4 to 12 inches.

Average daily departures from normal temperatures (degrees Fahrenheit) season of 1906.

Section.	From Jan. 1 to Apr. 2, inclusive.	For week ended—							
		April—				May—			
		9.	16.	23.	30.	7.	14.	21.	28.
New England	+1.4	−0.1	+1.1	+3.0	−1.1	+1.6	−4.0	+3.2	−0.7
Middle Atlantic States	+0.6	+1.8	+3.5	+5.8	+1.0	+5.8	−5.1	+5.2	+1.4
South Atlantic States	−0.7	+0.4	+6.1	+1.1	+1.9	+6.5	−7.5	+3.5	−1.4
Florida Peninsula	−1.2	−2.7	+1.7	−0.3	+1.3	+3.0	−0.7	+0.7	−0.3
Eastern Gulf States	−2.3	+1.6	+3.2	−1.1	+2.9	+3.9	−8.4	+2.5	−2.1
Western Gulf States	−1.5	+0.6	+0.4	−2.3	+3.4	+1.7	−4.8	+2.0	+0.8
Ohio Valley and Tennessee	−1.2	+2.8	+3.9	0.0	+3.9	+2.3	−6.9	+5.8	+3.9
Lower Lake Region	+1.2	+1.9	+4.4	+2.5	+0.5	+0.6	−5.9	+4.1	+4.4
Upper Lake Region	+2.0	+3.2	+3.7	+5.3	+3.4	−0.1	−3.4	+6.4	−0.9
North Dakota	+3.6	+5.3	+1.0	+9.3	+6.3	−4.0	+2.7	+0.7	−8.3
Upper Mississippi Valley	+0.1	+3.9	+1.4	+3.6	+5.3	−1.6	−1.4	+5.5	+1.3
Missouri Valley	+1.7	+2.2	+0.4	+5.5	+4.6	−7.3	+3.7	+7.0	+0.1
Northern Slope	+2.4	+1.3	+2.1	+9.3	+1.7	−3.0	+6.1	+3.1	−6.0
Middle Slope	+0.9	−1.7	+0.7	+4.2	+2.7	−2.2	+1.5	+6.3	−0.5
Southern Slope	−0.7	−2.5	+0.5	−3.5	+4.0	−1.5	−1.0	+1.7	−0.7
Southern Plateau	+1.2	−3.5	+0.8	+3.7	−4.7	−2.5	+0.3	+0.7	−5.3
Middle Plateau	+1.4	−1.2	+1.4	+7.2	−3.8	+1.4	+3.5	−0.3	−4.5
Northern Plateau	+1.4	+2.0	+2.0	+7.8	+0.2	+2.2	+6.6	−3.3	−5.2
North Pacific Coast Region	+1.9	+3.7	+1.6	+5.3	+1.9	+2.6	+1.9	−3.4	−2.3
Middle Pacific Coast Region	+1.7	+3.0	+2.0	+3.0	−3.0	+0.3	+0.3	−5.3	−6.7
South Pacific Coast Region	+2.0	−0.5	+1.0	+5.0	−5.0	+1.0	−1.2	−2.2	−4.8

Average daily departures from normal temperatures (degrees Fahrenheit), season of 1906—Continued.

Section.	For week ended— June— 4.	11.	18.	25.	July— 2.	9.	16.	23.	30.
New England	−2.2	+1.9	−3.7	−3.1	+0.9	−3.4	−1.1	+3.3	−1.4
Middle Atlantic States	−1.2	+4.7	−3.9	−1.4	+3.8	−1.9	−2.2	+2.4	−1.9
South Atlantic States	−0.6	+2.7	−3.4	+1.0	+3.2	−2.0	−2.5	+0.5	−2.5
Florida Peninsula	−0.3	−0.3	−0.7	−0.3	0.0	−0.3	−0.7	−0.3	−0.7
Eastern Gulf States	−0.5	+3.5	−1.5	+1.9	+2.2	−0.5	−1.9	−1.1	−1.1
Western Gulf States	+2.0	+3.9	−1.1	+0.4	+0.1	−2.8	−0.6	−1.4	−1.2
Ohio Valley and Tennessee	−2.2	+5.4	−5.1	−3.3	+2.8	−2.8	−1.2	−0.4	−3.2
Lower Lake Region	−3.5	+6.9	−5.2	−3.1	+2.1	−3.1	+1.0	+2.8	−1.6
Upper Lake Region	−1.1	+5.1	−4.0	−3.5	+2.2	−3.3	+1.4	+2.3	−0.2
North Dakota	+1.7	−0.3	+1.0	−9.0	−3.5	+1.0	−1.5	0.0	0.0
Upper Mississippi Valley	−1.2	−2.8	−5.0	−6.9	+1.7	−5.7	−1.0	−0.2	−2.2
Missouri Valley	−1.6	−1.8	−1.9	−7.9	−0.1	−4.9	−3.5	−1.8	−1.7
Northern Slope	−4.1	−2.1	−0.9	−9.4	−3.0	−2.4	−2.7	−6.9	+1.6
Middle Slope	−0.5	+3.0	−1.2	−6.5	−0.8	−7.8	−5.3	0.0	−2.7
Southern Slope	0.0	−3.7	−0.7	−0.3	+2.7	−8.0	−2.7	−1.3	+1.3
Southern Plateau	−6.3	−0.3	+3.0	−0.5	−3.8	−5.2	−0.7	−0.2	+1.0
Middle Plateau	−6.2	−3.7	−0.3	−4.5	−4.7	−1.3	+1.8	+1.2	+1.2
Northern Plateau	−6.2	−3.2	−2.0	−4.3	−3.2	+9.7	+8.0	−4.2	+2.8
North Pacific Coast Region	−6.3	−2.0	−2.3	+1.0	−1.0	+5.9	+6.1	+0.6	+1.1
Middle Pacific Coast Region	−4.7	−3.0	−3.7	+3.5	−3.3	+5.3	−3.7	−0.3	+1.7
South Pacific Coast Region	−4.0	0.0	+2.8	+2.5	−3.5	+2.8	+3.5	+0.5	+4.0

Section.	For week ended— August— 6.	13.	20.	27.	September— 3.	10.	17.	24.	October— 1.
New England	+1.0	−2.1	+ 1.7	−4.2	+1.3	− 0.3	+1.8	+ 6.4	−2.0
Middle Atlantic States	+1.9	+3.4	− 1.9	+3.8	+1.7	− 1.4	−4.5	+ 9.2	+2.9
South Atlantic States	−0.8	+3.7	+ 2.3	+1.5	−3.1	+ 1.5	+3.5	+ 5.8	+5.5
Florida Peninsula	−1.0	−0.3	0.0	−0.7	0.0	+ 1.3	+1.0	+ 1.3	+0.3
Eastern Gulf States	−0.8	−2.0	− 1.6	−3.2	−1.7	+ 2.0	+5.0	+ 3.0	+2.8
Western Gulf States	−0.2	−0.1	− 0.1	−1.0	0.0	+ 1.1	+5.0	− 3.9	+1.1
Ohio Valley and Tennessee	+1.8	−2.1	+ 2.8	+5.8	+0.8	− 2.0	+4.1	+ 7.2	+4.0
Lower Lake Region	+4.2	+1.8	+ 4.0	+7.9	−0.2	− 2.5	+5.2	+ 9.2	+1.6
Upper Lake Region	+2.9	+1.2	− 7.4	+5.9	−0.8	+ 6.6	+6.5	+ 6.2	+2.6
North Dakota	−3.0	+1.3	+10.3	−6.0	−6.3	−14.7	+0.3	+ 8.0	+5.3
Upper Mississippi Valley	+2.7	−0.7	− 3.8	+4.5	−0.5	− 4.6	+6.8	+ 6.4	+1.8
Missouri Valley	+0.8	−1.7	− 6.5	+6.4	−0.3	+ 7.1	−2.3	− 0.5	+1.6
Northern Slope	−2.9	−0.9	− 5.9	−5.7	−1.1	− 9.0	−5.1	+ 4.1	+4.1
Middle Slope	−0.7	−2.2	− 3.5	+0.8	−0.8	+ 3.0	−1.5	− 3.3	+0.5
Southern Slope	−2.0	−2.3	− 1.3	+0.3	0.0	− 1.0	+1.3	0.0	+1.0
Southern Plateau	−1.7	−1.2	− 1.3	−3.8	−3.0	0.0	−3.7	− 0.7	+2.0
Middle Plateau	−1.6	+2.0	− 1.5	−5.5	−0.3	− 2.7	−7.0	+ 1.7	+2.8
Northern Plateau	−4.2	+6.0	− 1.0	−5.8	+3.8	+ 5.5	−6.6	−10.3	+3.8
North Pacific Coast Region	−0.7	−2.8	− 1.9	+1.4	+1.4	+ 0.7	−1.6	− 3.4	−9.9
Middle Pacific Coast Region	−0.7	−1.3	− 1.[illegible]	−1.7	−1.0	+ 0.3	−1.3	+ 1.3	−4.0
South Pacific Coast Region	−0.2	+1.2	+ 2.2	−3.2	−9.5	− 0.5	−2.2	− 4.0	+3.5

Departures from normal precipitation (inches and hundredths) season of 1906.

Section.	From Jan. 1 to Apr. 2, inclusive.	For week ended—							
		April—				May—			
		9.	16.	23.	30.	7.	14.	21.	28.
New England	−0.61	−0.58	+1.22	−0.66	−0.37	+0.17	−0.49	−0.66	+0.95
Middle Atlantic States	−1.32	−0.56	+1.16	−0.58	−0.58	+0.13	−0.63	−0.72	+0.26
South Atlantic States	−1.21	−0.80	+0.09	−0.69	−0.51	+0.06	−0.52	−0.77	+1.48
Florida Peninsula	+2.36	−0.48	+0.70	−0.27	−0.41	−0.60	−0.25	−0.22	+3.20
Eastern Gulf States	−1.07	−1.05	−0.26	−0.97	−0.08	+1.08	−0.66	−0.61	+0.37
Western Gulf States	−3.72	−0.57	−0.18	−0.31	−0.70	+0.89	−0.89	−0.23	−0.45
Ohio Valley and Tennessee	−3.40	−0.22	−0.16	−0.77	−0.52	+0.17	−0.86	−0.78	+0.22
Lower Lake Region	−2.82	+0.12	+0.32	−0.37	−0.45	−0.21	+0.14	−0.74	−0.45
Upper Lake Region	+0.18	+0.12	+0.01	−0.58	−0.35	−0.05	−0.13	−0.52	+0.02
North Dakota	−0.50	−0.11	+0.30	−0.50	−0.32	−0.05	0.00	+0.56	+1.28
Upper Mississippi Valley	+0.65	+0.32	−0.27	−0.71	−0.53	−0.20	−0.28	−0.49	+0.76
Missouri Valley	+0.41	+0.13	+0.14	−0.65	−0.11	−0.02	−0.76	−0.64	+0.25
Northern Slope	+0.59	−0.02	−0.14	−0.25	+0.26	−0.02	−0.26	−0.16	+1.14
Middle Slope	−0.39	+0.59	+0.21	−0.28	+0.33	−0.40	−0.81	−0.48	+0.16
Southern Slope	−1.22	+0.85	−0.28	+0.58	−0.48	−0.34	−0.32	−0.51	0.00
Southern Plateau	+0.72	+0.36	−0.04	+0.06	0.00	−0.05	−0.05	+0.06	−0.06
Middle Plateau	+1.45	+0.29	+0.03	−0.09	−0.23	−0.02	+0.34	−0.16	+0.51
Northern Plateau	−0.25	−0.27	−0.20	−0.28	−0.08	−0.33	−0.26	+0.09	+0.50
North Pacific Coast Region	−5.20	−0.66	−0.82	−0.73	−0.18	−0.73	−0.13	+0.48	+0.26
Middle Pacific Coast Region	+5.87	−0.63	−0.54	−0.46	+0.66	−0.50	−0.28	+0.32	+1.79
South Pacific Coast Region	+5.08	−0.16	−0.28	−0.28	+0.31	−0.06	+0.17	−0.07	+1.09

Section.	For week ended—								
	June—				July—				
	4.	11.	18.	25.	2.	9.	16.	23.	30.
New England	+0.81	+0.16	+0.53	+0.22	+0.09	+0.22	−0.22	−0.22	+0.27
Middle Atlantic States	+0.09	+0.13	+0.52	+0.42	−0.31	+0.14	+0.12	+0.92	+0.39
South Atlantic States	−0.41	+0.14	+3.56	−0.59	−0.50	+0.51	+0.33	+0.49	+0.42
Florida Peninsula	−0.76	+1.18	+2.07	+0.16	−1.41	+0.96	−0.13	−0.97	+2.36
Eastern Gulf States	−0.61	−0.59	+0.63	−1.08	+0.02	−0.02	+0.85	+1.08	+0.01
Western Gulf States	+0.19	−0.81	−0.76	−0.12	+0.14	+0.04	+0.32	+0.34	+0.37
Ohio Valley and Tennessee	−0.06	+0.14	−0.18	−0.08	−0.47	+0.02	−0.03	+1.32	−0.02
Lower Lake Region	−0.80	+0.54	+0.10	−0.29	−0.19	+1.03	−0.42	+0.31	+0.24
Upper Lake Region	−0.52	+0.41	−0.59	−0.14	+0.36	−0.63	−0.09	−0.19	+0.37
North Dakota	+0.40	+1.42	−0.39	−0.46	+0.86	−0.74	−0.20	−0.40	−0.16
Upper Mississippi Valley	−0.43	−0.07	−0.89	−0.09	+0.17	−0.65	−0.40	−0.28	−0.01
Missouri Valley	+0.04	−0.66	−0.14	+0.34	+0.29	−0.80	+0.03	+0.19	−0.43
Northern Slope	+0.12	+0.23	−0.25	−0.02	−0.22	−0.36	+0.10	−0.27	−0.08
Middle Slope	−0.32	−0.56	+0.10	−0.12	−0.05	−0.34	+1.00	−0.10	+0.36
Southern Slope	+1.41	−0.53	−0.70	−0.31	−0.56	+0.08	+0.41	+0.11	−0.22
Southern Plateau	0.00	−0.07	−0.06	−0.08	−0.12	+0.47	−0.04	−0.19	−0.21
Middle Plateau	+0.18	−0.01	−0.04	−0.09	+0.12	+0.24	−0.02	−0.06	+0.16
Northern Plateau	+1.67	−0.02	−0.08	−0.24	+0.15	−0.04	−0.12	−0.03	−0.07
North Pacific Coast Region	−0.03	+0.38	+0.61	−0.39	+0.20	−0.25	−0.08	−0.16	−0.16
Middle Pacific Coast Region	+0.08	+0.03	+0.22	−0.09	+0.07	−0.03	0.00	0.00	0.00
South Pacific Coast Region	+0.10	−0.02	−0.01	0.00	0.00	0.00	0.00	0.00	0.00

Section.	For week ended—								
	August—				September—				October.
	6.	13.	20.	27.	3.	10.	17.	24.	1.
New England	+0.11	−0.35	−0.87	−0.22	+0.08	−0.54	−0.43	+0.25	−0.31
Middle Atlantic States	+0.35	+1.07	−0.12	+0.43	+0.46	−0.82	−0.34	−0.52	−0.59
South Atlantic States	+0.38	−0.73	−0.24	+0.01	+0.50	−0.47	−0.76	+0.12	−0.26
Florida Peninsula	+0.91	+0.40	−0.76	+0.78	−0.80	−0.92	−1.37	−1.30	+1.98
Eastern Gulf States	−0.71	−0.26	+0.25	0.00	−0.31	+0.78	−0.36	+0.79	+5.52
Western Gulf States	−0.40	+0.67	−0.15	−0.06	−0.65	+0.30	−0.51	−0.71	+0.32
Ohio Valley and Tennessee	−0.59	+0.40	+0.34	−0.09	−0.25	−0.13	−0.26	+0.42	+1.63
Lower Lake Region	−0.35	+1.06	−0.38	+0.20	−0.13	−0.69	−0.66	−0.16	+0.79
Upper Lake Region	−0.14	+0.17	−0.43	+0.74	−0.28	−0.79	+0.07	+0.23	+0.30
North Dakota	+0.53	−0.09	−0.05	+0.45	−0.32	−0.30	+0.42	−0.04	−0.18
Upper Mississippi Valley	+0.03	+0.97	+0.48	+0.02	+0.03	−0.51	+0.01	−0.47	+1.02
Missouri Valley	+1.27	+0.67	−0.57	+0.54	−0.10	−0.49	+1.42	+0.59	−0.04
Northern Slope	+0.55	+0.23	+0.02	+0.64	−0.08	−0.22	+1.09	−0.04	−0.21
Middle Slope	+0.01	+0.20	−0.28	+0.61	+0.92	−0.22	+1.86	+0.51	−0.22
Southern Slope	+0.22	+1.85	−0.46	+0.65	+0.19	+0.10	−0.22	−0.35	−0.24
Southern Plateau	+0.48	−0.15	+0.24	+0.20	−0.19	−0.19	+0.12	−0.14	+0.12
Middle Plateau	+0.05	−0.09	+0.18	+0.43	+0.14	−0.16	+0.66	−0.17	−0.03
Northern Plateau	+0.02	+0.24	+0.11	+0.11	−0.13	−0.05	+0.23	−0.20	−0.22
North Pacific Coast Region	−0.14	−0.04	−0.09	−0.25	−0.39	+1.60	+0.62	−0.24	−0.32
Middle Pacific Coast Region	0.00	0.00	−0.01	−0.02	−0.05	−0.03	−0.03	+0.02	−0.28
South Pacific Coast Region	−0.02	−0.02	0.00	+0.02	0.00	0.00	+0.02	−0.04	−0.05

THE LIVE-STOCK INDUSTRY IN 1906.

By A. D. MELVIN, *Chief of the Bureau of Animal Industry.*

In spite of the violent agitation which prevailed during a considerable portion of the year against conditions at some of the large packing houses, and which seriously affected the trade in certain classes of meat products, it can truly be said that 1906 was in most respects a highly successful year for the live-stock industry. The public prejudice against the lower grades of meat products reacted in favor of the better grades, and the prices obtained for the latter reached a very remunerative point for the producer.

INCREASE IN PRICES.

As regards the cattle trade, prices have risen all along the line. The average price of native cattle at the Chicago stock yards for the year was $5.60, as against $5.05 in 1905. This is an increase of 55 cents on every 100 pounds of live weight, or 11 per cent. Texas cattle rose from $4.20 to $4.45, and western cattle made the highest gain of any, their average going from $3.80 to $4.40. Another instance of the prosperous condition of the cattle trade may be cited in connection with the public sales of pure-bred beef cattle in the United States during 1906, which totaled close upon 7,000 animals—an advance of fully 10 per cent on 1905; and there was also a considerable increase in the average price per head.

Hog growers had a phenomenally successful year. The hogs sold at Chicago during the year, according to a good market authority, realized $15,000,000 more to the raisers than was received in 1905, and the average price on the market was an even $1 per hundredweight more than in 1905—an increase of 19 per cent. Sheep raisers had a good year also, although their increases were not as great as the preceding.

INCREASE IN EXPORTS.

While the home market thus maintained a highly satisfactory condition, the export trade in animal products reached the highest amount yet attained, the total value of these exports for 1906 being $296,527,588, an advance of $23,144,694 over 1905. Previously the highest total value of animal products exported in one year had been $286,826,152, in 1901. There was a heavy falling off in exports of canned meats in 1906, due, of course, to the agitation before mentioned, but it is gratifying that this decrease was more than offset by gains in other classes of meats. The public, both foreign and domestic, has evidently discriminated very carefully between canned meats, which were most affected by the insanitary conditions at packing houses, and fresh meat, the wholesomeness of which was never seriously questioned in all the discussion of packing-house conditions.

NUMBERS AND VALUES OF FARM ANIMALS, JANUARY 1, 1907.

The prosperous condition and the vastness of the live-stock industry are well shown by the annual estimate of the number and value of farm animals on farms and ranges January 1, 1907, by the Bureau of Statistics of this Department, as follows:

Number and value of farm animals in the United States, January 1, 1907.

Farm animals.	Number.	Per cent compared with January 1, 1906.	Average price per head.	Value.
Horses	19,747,000	100.9	$93.51	$1,846,578,000
Mules	3,817,000	102.5	112.16	428,064,000
Milch cows	20,968,000	102.4	31.00	645,497,000
Other cattle	51,566,000	98.0	17.10	881,557,000
Sheep	53,240,000	103.7	3.84	204,210,000
Swine	54,794,000	99.5	7.62	417,791,000

The total value reaches the stupendous sum of $4,423,697,000. The above statement shows an increase during 1906 in the number of all classes of animals except "other cattle" and swine, and the decrease in swine was insignificant. A striking enhancement in the value of farm animals during the year is shown by comparing the

average prices per head as estimated on January 1, 1906, and on January 1, 1907. The increase per head in each class is as follows: Horses, $12.79; mules, $13.85; milch cows, $1.56; other cattle, $1.25; sheep, $0.30; swine, $1.44.

LIVE-STOCK EXHIBITIONS.

Live-stock shows are an important educational factor for improvement in breeding and feeding. The two principal exhibitions of the year were the "American Royal," at Kansas City, in October, and the "International," at Chicago, December 1 to 8. At each of these shows there was brought together a splendid collection of fine breeding and fat stock. In number and high quality of exhibits and in magnitude of attendance the International Exposition of 1906 surpassed all previous exhibitions. There were on exhibition in this show 6,043 animals, as follows:

Exhibits at the International Exposition at Chicago, December, 1906.

Class.	Individual exhibits.	Carload exhibits.	
		Number of carloads.	Number of animals.
Fat cattle	1,067	97	1,455
Feeding cattle		39	780
Horses	609		
Sheep	897	17	877
Hogs	258	2	100
Total	2,831	155	3,212

Most of the animals were in the younger classes, and the grand champion of the show was a Hereford calf 11 months old.

CHANGE IN LAW REGARDING TRANSPORTATION OF LIVE STOCK.

The statute commonly known as the twenty-eight hour law was changed by act of Congress approved June 29, 1906. The old law, passed in 1873, prohibited the confinement in cars, boats, or other vessels, for a longer period than twenty-eight consecutive hours, of cattle, sheep, swine, or other animals in transit from one State to another, without unloading the same for rest, water, and feeding for at least five hours, unless the animals were carried in cars, boats, or vessels in which they could and did have proper feed, water, space, and opportunity to rest. For some years there had been many violations of this law by railroads, despite the Department's efforts to enforce it. While the object of the law was good, in many cases it was a greater hardship to the animals and to the shippers to have the law complied with than to carry the animals on to destination without unloading. At length the dissatisfaction on the part of shippers led to the enactment of the new law, which permits an extension of the time to thirty-six hours on the written request of the owner or person in custody of the shipment. This request must be separate and apart from any printed bill of lading or other railroad form. Sheep, on account of their well-known objection to moving at night, are not required to be unloaded during the night, but the time of their confinement may not be extended beyond thirty-six hours. In most other respects the new law is similar to the old, though occasion was taken to correct some defects of the old law. The penalty for each violation is from $100 to $500.

THE MEAT INSPECTION.

An important event of the year was the extension of the meat-inspection service of the Bureau of Animal Industry, consequent upon the passage of the law of June 30, 1906.

As the conditions at the Chicago stock yards and packing houses have been so prominently before the public, it may be well to point out certain facts regarding the meat-inspection service as conducted by the Bureau.

Until the passage of the new meat-inspection law on the last day of the fiscal year (June 30, 1906), the inspection was carried on under the act of March 3, 1891, as amended by the act of March 2, 1895. That law provided for—

1. The inspection of all live cattle which were intended for export or whose carcasses or products were intended for export.

2. (a) The mandatory ante-mortem inspection of cattle, sheep, and hogs which were subjects of interstate commerce and which were about to be slaughtered at slaughterhouses, canning, salting, packing, or rendering establishments in any State or Territory, the carcasses or products of which were to be transported and sold for human consumption in any other State or Territory or the District of Columbia.

(b) The additional permissive post-mortem examination of carcasses of all cattle, sheep, and hogs about to be prepared for human consumption at any slaughterhouse, canning, salting, packing, or rendering establishment in any State or Territory or the District of Columbia, and which were the subjects of interstate commerce.

In other words, the ante-mortem inspection was made mandatory, while the post-mortem examination was only discretionary.

Some of the defects and limitations of this law should be noted to give an idea of the disadvantages under which the inspection was conducted. In the first place, the law required the ante-mortem inspection of all cattle, sheep, and swine slaughtered at certain classes of establishments the carcasses or products of which were to enter interstate commerce, but no specific provision was made for funds with which to perform this work, and the annual appropriation had never been sufficient to enable the Bureau to cover all establishments carrying on an interstate business. Indeed, many establishments which applied for inspection had to be refused on account of lack of money to carry on the work.

While the law authorized the marking of meats and products which on inspection were found free from disease and wholesome and prohibited the interstate shipment of meats and products found diseased and unwholesome, it made no provision and gave no authority for marking and rendering unfit for food purposes the diseased and unwholesome carcasses and products. As a matter of fact, however, it has long been the practice of the Bureau to require the destruction of all condemned carcasses and parts, though, in case of the refusal of the proprietor to comply with such orders, there was no remedy except to withdraw inspection.

It is very doubtful whether the law gave any authority for following up meats after they had once been inspected and passed immediately after slaughter or for condemning any such meat which might afterwards become unwholesome or unclean before or during the process of canning or packing or before being placed on the market. But whether the law gave any such authority or not is a purely academic question, since the lack of funds made it impossible to extend the inspection to cover all the processes of curing, canning, packing, etc. No authority whatever to control the sanitation of the establishments or to prevent adulteration or the use of chemicals and preservatives was given by the law.

The inspection was therefore practically confined to the ante-mortem inspection of animals and the inspection of the carcasses immediately after slaughter. The meat found free from disease and otherwise wholesome at the time of this post-mortem inspection was properly marked, and that found diseased or unwholesome was destroyed. There is no question that this inspection was efficient as far as it went and that it went as far as the law and the limited appropriations allowed. In all the recent agitation the wholesomeness of the inspected fresh meat was not seriously called into question. The disclosures of unsatisfactory conditions related almost wholly to the canned and prepared meats, the use of preservatives, and the insanitary condition and methods of the packing establishments—matters over which the Bureau has had no control whatever under the law.

The new law of June 30, 1906, greatly enlarged the powers of the Secretary of Agriculture and made a permanent annual appropriation of $3,000,000 to pay the cost of meat inspection. With the additional authority and money thus granted the service has been greatly extended and strengthened.

The most important changes in the meat inspection brought about by the operation of the new law may be summarized as follows:

(1) The number of establishments at which inspection is carried on increased from 154 on June 30 to 644 on December 31.

(2) Previously the law provided for inspection only before and at the time of slaughter. The inspection is now extended to all departments of the abattoirs and packing houses and covers all the various stages and processes of preparation, curing, canning, packing, etc.

(3) From no control whatever of sanitation the service has been extended to complete control. As a result improvements have been made at practically all establishments, ranging from slight modifications to almost complete reconstruction. Weekly reports on sanitation are received.

(4) The old law required inspection only at houses doing export beef business. The new law requires inspection for all interstate as well as export business, except in the case of farmers and retail butchers and dealers supplying their customers.

(5) Previously there had been no control over transportation of meats and meat food products. Under the new law there is complete control over interstate transportation. Every shipment must be covered by a certificate showing either that the meat has been inspected and passed or that it is exempt from inspection.

(6) Instead of no authority over trade labels, the Department is now empowered to prevent fraudulent and misleading labeling of meat products.

(7) From no control over processes of preparation of meat food products and the use of chemicals, preservatives, etc., the Department has complete control over such matters. Careful chemical examinations are made to enforce this feature of the new law.

(8) Formerly it was possible to withdraw animals that had been rejected at antemortem inspection and have them slaughtered elsewhere for local use. This is no longer permitted. All animals must be slaughtered and properly disposed of at the establishment for which bought and where the inspection takes place.

It should be remembered, however, that the Federal jurisdiction is limited to interstate and foreign commerce, and that this inspection can legally be applied only to establishments doing an interstate or foreign business. As a matter of fact, the Department insists upon inspecting the entire output of each establishment at which its inspection is maintained, even though the greater part of the product is to be consumed within the State; but the Federal inspection does not and can not reach the establishments doing business exclusively within a State. Some of the worst conditions have been found at places of the latter kind. Such places must be looked after by the State and municipal authorities. In the absence of an efficient local inspection the consumer should see that meat bears the Government label.

ERADICATION OF THE CATTLE TICK.

The year 1906 also witnessed the inauguration of systematic work by cooperation between the United States Department of Agriculture and State authorities for the eradication of the tick which transmits the infection of Texas fever of cattle. For many years this tick and the infection which it spreads have been a great handicap to the live-stock industry of the South. It is estimated that the tick is responsible for about $40,000,000 of loss annually to the people in the infected country, and that it also lowers the assets of the South by an additional $23,250,000.

On June 30, 1906, Congress appropriated $82,500 for the Department to undertake the work of tick eradication in cooperation with State authorities. Although the time was short for effective work during that season, the results accomplished were very gratifying and encouraging. They indicate that the eradication of the tick is entirely possible, though it is recognized as a large and difficult undertaking—one that will require several years and considerable money for its accomplishment. It is believed that, as a result of the work during 1906, forty whole counties and parts of eleven other counties, with an area larger than the State of Virginia, can be safely released from quarantine. In some States adequate laws are lacking, and in some no funds are available for such work. These conditions must be remedied if the work is to be continued successfully. The eradication of the cattle tick will be of incalculable advantage to the South and of great benefit to the entire country, and it is believed that money wisely spent in this work will be a splendid investment for the States and the Nation. An important conference of Federal and State representatives engaged in the work of tick eradication was held at Nashville, Tenn., December 5 and 6, 1906.

CONTROL OF CONTAGIOUS DISEASES.

The work of eradicating sheep scab and cattle mange in the West was continued vigorously during the year by the Bureau of Animal Industry, with the cooperation of State and Territorial authorities. These diseases are being gradually brought under control. Already Wyoming, Idaho, Utah, and Arizona have been practically freed from sheep scab, and the disease has been greatly diminished in other States. Such satisfactory progress has not been made, however, against cattle mange on account of the lack of the same hearty cooperation from cattle owners that is received from sheep owners. This work consists principally of inspection and dipping on the range and at shipping points, the object being to strike the evil at its source and thus prevent the contamination of the channels of interstate commerce and the spread of the infection. This work means an immense saving to the stockmen of the country. The eradication of sheep scab results in the production of a much larger amount of wool than is possible when the disease is present. One flockmaster with 40,000 head of sheep has stated that the dipping increased the yield of wool of his sheep 1½ pounds a head, which, at the value of 20 cents a pound, amounted to $12,000. In many flocks the proportion of increase has been much greater.

The free distribution of blackleg vaccine to stock owners by the Bureau of Animal Industry has been continued, with the usual good results. During the year 1,279,280 doses were prepared and sent out. The losses among vaccinated calves are extremely small, and the prevalence of the disease is being gradually reduced.

SCIENTIFIC INVESTIGATION OF DISEASES.

The scientific investigation of animal diseases by the Bureau of Animal Industry yielded results of especial importance regarding tuberculosis and hog cholera during 1906.

The urgent need to strengthen the fight against tuberculosis, especially among cattle, is becoming more apparent every day, and it is believed that the eyes of the breeders and feeders of animals are opening to this fact. It has been shown by the work of the Bureau of Animal Industry that the most important factor in the dissemination of tubercle bacilli by cattle is their feces. Heretofore it has been supposed that milk was not likely to contain the germs of tuberculosis unless the cow's udder was affected. Experiments made at the Bureau Experiment Station have demonstrated, however, that the excrement of tuberculous cattle is usually heavily charged with tubercle bacilli, and that with the usual methods of milking the milk easily becomes contaminated by particles of bacilli-laden manure. In this way a single tuberculous cow may be the means of infecting the milk of an entire herd.

It has also been demonstrated that probably the most fruitful causes of tuberculosis in hogs are the common practices of allowing these animals to follow cattle in the feed lot and feeding them on skimmed milk or separator refuse. The alarming increase of tuberculosis among hogs is almost entirely traceable to their association with affected cattle. The sterilization of all skimmed or separated milk from public creameries before it is fed to calves or pigs is recommended.

The relative importance of dried and pulverized tuberculous material as compared with that which is moist and fresh has received some attention, and it has been pointed out that the danger from the latter has been undervalued, mainly because dried and pulverized material is in better harmony with the commonly accepted respiratory theory of infection with tuberculosis. The respiratory theory has been shown to be unnecessary to account for the frequency with which tuberculosis is an infection of the lung, and it has been shown that the tubercle bacilli usually reach the lung irrespective of the manner of their introduction into the body. For instance, tuberculosis of the lungs was produced by inoculating hogs in the tip of the tail.

The tuberculin test, with proper precautions, was proved to be about as accurate with hogs as with cattle. Reliable results were obtained in 97 per cent of the animals tested. It is necessary, however, to keep the hogs very quiet before and during the test to prevent rise of temperature from causes other than the tuberculin.

The scientific investigations of the year, both by the Bureau and by outside investigators, have tended to confirm the view that human and bovine tuberculosis can not be classed as two distinct diseases, that tubercle bacilli of persons and of animals are not distinct and separate varieties but vary only as a result of adapting themselves to the different environments encountered in different species of animals, and that measures to protect persons against infection with tuberculosis from animals are necessary.

Whether regarded from the standpoint of protecting human health or of promoting the welfare of the live-stock industry, it is highly important for our farmers, stock raisers, and dairymen to eliminate tuberculosis from their herds.

For many years hog cholera has been a cause of heavy loss to the farmer and a puzzle to the scientist. Two or three years ago the Bureau of Animal Industry discovered that the cause of the most acute and virulent forms of the disease is a virus that can pass through the finest filter and is invisible under the microscope. This has been confirmed by later experiments by the Bureau and by European scientists. During the past year the efforts of the Bureau have been directed toward developing a vaccine or serum which will prevent and cure the disease. A successful remedy has been worked out in an experimental way, and efforts are being made to adapt it to practical and general use. This method has been patented by Dr. Marion Dorset, chief of the Biochemic Division of the Bureau, in such a way as to allow anybody in the United States the right to its use free of royalty.

Some valuable work in the investigation of internal parasites of sheep was done by the Bureau in 1906. The prevalence of these parasites has done great damage to the sheep industry in the eastern half of the United States, and has caused thousands of farmers to abandon sheep raising. By carefully studying one of the most troublesome of these parasites (the stomach worm, *Hæmonchus contortus*) and establishing

the principal facts in its life history, the Bureau has placed before sheep raisers information (Circular No. 102, Bureau of Animal Industry) which will enable them very largely to prevent its ravages. Experiments indicate that it is entirely feasible to raise lambs free from this and some other injurious parasites.

ANIMAL BREEDING AND FEEDING EXPERIMENTS.

The experiments in breeding horses in Colorado, conducted cooperatively by the Bureau of Animal Industry and the Colorado Experiment Station, have attracted considerable attention. The object is to develop from native stock a strain of carriage horses. The stud is headed by the stallion Carmon 32917, American Trotting Register. The first crop of foals came during the spring of 1906, and while it is early to pass an opinion on them, they show the stallion to be a good investment as a sire.

Experiments in breeding Morgan horses were begun in Vermont in 1906 by cooperation between the Bureau and the Vermont Experiment Station, with the object of preventing the loss of the Morgan blood, preserving the type, and at the same time increasing the size over that of the old Morgan. Nine mares have been purchased, and a stallion will probably be added.

During the year experiments were also begun by the Bureau, in cooperation with the Wyoming Experiment Station, in breeding range sheep. In spite of the great development and prosperity of the sheep industry of the West, breeding methods are not systematic, and most breeders are continually crossing, the result being a lack of uniformity in the stock and, to a certain extent, a failure to attain as high a standard as might otherwise be possible. The requirement of the range is a breed of sheep that will yield a profitable clip of wool, produce good mutton lambs, and that will stand flocking in large numbers. It is believed to be possible to combine these characteristics in one breed of sheep, and this is the object of the experiments.

The Bureau being urged to undertake experiments to counteract the supposed decline in fecundity of Poland-China sows, made a careful study of the pedigree records for several years, with the surprising result that the average litter was found to have increased from 7.04 pigs in 1882–1886 to 7.52 in 1898–1902. Similar studies for the Duroc-Jerseys showed the rate to be practically stationary at about 9.25.

The following cooperative experiments are also under way and are progressing satisfactorily: Animal nutrition, studied with the respiration calorimeter (Pennsylvania); beef production in the South (Alabama); poultry breeding and management (Maine), and turkey breeding with the object of developing resistance to the disease known as blackhead (Rhode Island). The Maine poultry experiments have shown that the egg-laying capacity of hens may be increased by selective breeding and proper feeding. Several of the hens have laid more than 200 eggs in one year. The success of this work means a substantial addition to the income of the farmers of the country. During the year the Bureau of Animal Industry began experiments near Washington, D. C., in feeding poultry to test the relative values of moist mash, dry mash, and so-called self-feeding hoppers.

PEDIGREE REGISTRATION.

The regulations of the Department of Agriculture with regard to the pedigree registration of animals imported for breeding purposes were radically changed during the year, new regulations having been issued as Bureau of Animal Industry Order No. 136, effective July 1.

The tariff laws of the United States permit a citizen to import animals free of duty for breeding purposes if they are purebred, of a recognized breed, and duly registered in the books of record established for the breed, the Secretary of Agriculture being authorized "to determine and certify to the Secretary of the Treasury what are recognized breeds and purebred animals." To carry out these provisions the Secretary of Agriculture certifies certain pedigree-record associations to the Secretary of the Treasury, and only animals which are recorded in these books are entitled to free entry. Foreign books of record are certified only as the associations controlling them may be affiliated with American associations, except in cases where a recognized foreign breed may have no book of record in the United States, in which case the foreign book is certified direct. It follows, of course, that in practically all cases only animals registered in American books can be imported free. The Department closely supervises the certified American associations, requires them to submit annual reports, and examines their books when necessary. The certification of the Secretary of Agriculture adds considerable prestige to an association doing business in this country, and two States (Wisconsin and Iowa) have passed laws requiring stallions standing as purebred to be registered in a studbook so certified.

THE DAIRY INDUSTRY.

Results of great practical value to the dairy industry were accomplished by the work of the Dairy Division during 1906.

One experiment, begun in 1905 and concluded in 1906, consisted in making about 5,000 pounds of butter under different conditions and carrying it in storage for several months at different temperatures. The conclusion was that light salting and low temperatures and the use of sweet cream give much the best results for storage butter. Further experiments with the storage of about 3,000 pounds of butter made in 1906 are still in progress.

The quality and character of butter received at some of the principal markets are studied and defects reported to the makers and creamery owners. In the beginning this work was looked upon rather skeptically by the butter merchants, but now they are heartily in favor of its continuance because of the consequent improvement in butter and because it helps to establish confidence between the butter merchant and the butter maker. Over a thousand creameries have been assisted in this way, many of them to their material advantage.

Coating butter tubs with paraffin was found to be a good method of preventing mold, and a simple and rapid method of determining the water content of butter was devised. Both these methods were described in publications issued during the year. The determination of water in butter is a matter of much interest and importance to the butter maker and dealer, and the methods previously in use have required expensive apparatus, skill to operate it, and several hours to make a determination. By the use of the new method, requiring apparatus costing but a few dollars, anyone of average intelligence may make moisture determinations, the time required being from fifteen to twenty minutes.

Investigations in cooperation with the Storrs (Conn.) Experiment Station regarding the manufacture of European varieties of cheese have demonstrated that the Camembert and Roquefort types of cheese can be made successfully and profitably in the United States. Experiments in the manufacture and storage of American cheese have shown the value of cold curing to meet the growing demand for mild cheese.

A splendid object lesson in the value of sanitary dairying was given at the Chicago dairy show in February, 1906. Milk and cream were shipped hundreds of miles and kept for weeks with no means of preservation other than cleanliness and cold.

Recent improvements in milking machines have led to their introduction and practical use in some of the larger dairies of the country. Over a thousand of these machines are reported to be in use, and there are indications that they may come into general use in the near future and become an important economical factor in the dairy industry. The Dairy Division has made a careful study of the milking machine from both the practical and the scientific standpoint, and a preliminary report has been published. These investigations are being continued.

The Dairy Division has also made and is making a study of all classes of dairy buildings, such as creameries, cheese factories, barns, ice houses, milk houses, dairy refrigerating plants, etc. A limited number of plans have been drawn of these various types of buildings for individuals in various parts of the country, with a view to studying the conditions necessary to be met and fulfilled in buildings for these purposes.

The inspection of renovated butter and of the factories producing the same under the law of May 2, 1902, has resulted in a marked improvement in the quality of this product. The general sanitary condition of factories has improved materially from past years, and there have been fewer violations of the law and regulations.

A careful preliminary survey of dairy conditions in the South has been made as the first step in the direction of improving and developing the dairy industry in that section. In some cases herds were found producing as good results as are ordinarily expected in any section of America. At other places milk was produced as cheaply as in any dairy section of the country. On the whole, there was an enormous demand for dairy products. Almost all butter and cheese was obtained from other sections, some cream being shipped a great distance. Condensed milk and cream find a great market throughout all the southern cities. Silage is used to a very limited extent in the South. One of the great drawbacks to dairying in the South is the inferior grade of cattle found there. It is probable that this poor quality of dairy stock is due in large part to the presence of the cattle tick and the infection of Texas fever. There is great need throughout the South for education in improved methods of dairy breeding and feeding and milk production. The investigations so far have shown that there is a great desire on the part of many southern people to know more about dairying. They are anxious for something that will enable them to get away from the one-crop system. The action of Congress in appropriating $20,000 for the extension of this work during the fiscal year 1907 indicates that its importance is beginning to be realized. The prospects are very good, and there is every reason to believe that this work will be the means of developing a splendid dairy industry in the South.

PLANT DISEASES IN 1906.

By W. A. Orton, *Plant Pathologist, Bureau of Plant Industry.*

This article summarizes reports on the distribution and prevalence of plant diseases received during the year in this Department and the several State experiment stations, whose cooperation is gratefully acknowledged. Especial assistance has been given by the following collaborators of this Department in their respective experiment stations: G. E. Stone, Massachusetts; H. H. Whetzel, New York; J. B. S. Norton, Maryland; A. D. Selby, Ohio; J. L. Sheldon, West Virginia; F. L. Stevens, North Carolina; E. Mead Wilcox, Alabama; L. H. Pammel, Iowa; F. D. Heald, Nebraska; H. L. Bolley, North Dakota; W. Paddock, Colorado; R. Kent Beattie, Washington.

Comparisons may be made with conditions in previous years, which are recorded in the eight preceding yearbooks. The data available does not include some sections of the country, and the distribution of the diseases is not fully known, particularly in the case of the less important ones.

POME FRUITS.

Apple.—**Bitter-rot** (*Glomerella rufomaculans* (Berk.) Sp. & von Schr.) was less destructive than last year, though it occurred generally throughout Virginia and West Virginia and in North Carolina, South Carolina, Tennessee, and Kentucky. There was less in Maryland, Ohio, and Indiana. It was reported from Delaware, New Jersey, and Nebraska.

Black-rot and **Canker** (*Sphaeropsis malorum* Pk.) were reported everywhere from New Hampshire to Alabama, and from Nebraska.

Blackspot canker (*Gloeosporium malicorticis* Cordley) occurred about as usual west of the Cascade Mountains in Washington and was found by Doctor Heald in western Nebraska.

Blight (*Bacillus amylovorus* (Burr.) De Toni) was much more severe than usual in Delaware, New Jersey, Maryland, New York, Virginia, West Virginia, Tennessee, Kentucky, Missouri, and Arkansas. The loss in Nebraska was estimated at $10,000. It continues to spread in Colorado, Utah, and Wyoming, and in the Sacramento Valley of California. It was much less severe than last year in Alabama, Georgia, and North Carolina, and was comparatively slight in New England.

Blotch (*Phyllosticta* sp.), a disease hitherto unstudied, has been described by W. M. Scott, of this Department, in Farmers' Bulletin 283. It occurs in Maryland, Virginia, West Virginia, and Arkansas, and has often been confused with scab by growers there. Spraying experiments by Mr. Scott resulted in the control of the disease.

Brown-rot (*Sclerotinia fructigena* (Pers.) Schrt.) was observed on apples in Nebraska, Missouri, and West Virginia.

Crown-gall was increasingly serious in Colorado, Utah, and Washington, and very common in Maryland, Kentucky, North Carolina, and neighboring States.

Fly-speck (*Leptothyrium pomi* (Mont. & Fr.) Sacc.) and **Sooty blotch** (*Phyllachora pomigena* (Schw.) Sacc.) were very prevalent in Connecticut, New York, Pennsylvania, Maryland, West Virginia, and eastern Nebraska; less common this year in Ohio and Indiana, and quite rare in northern Vermont.

Illinois canker (*Nummularia discreta* (Schw.) Tul.) was reported from Illinois, Missouri, Arkansas, Nebraska, and West Virginia.

Leaf-spot (*Phyllosticta* spp. and other fungi) defoliated unsprayed trees six weeks before the normal period of leaf fall in Nebraska, Missouri, Arkansas, West Virginia, and North Carolina. Less injury was reported from Ohio, about the usual amount in Indiana, and considerable in Illinois. There was very little in Vermont.

Physiological fruit-spot was reported to be much worse in New Hampshire.

Powdery mildew (*Sphaerotheca mali* (Duby) Burr., and *Podosphaera oxycanthae* (DC.) De By. occurred in Iowa, California, Washington, and West Virginia, especially on nursery stock.

Root-rots (*Clitocybe parasitica* Wilcox, in part?) were reported from Arizona, Colorado, Washington, southern Indiana, Arkansas, Missouri, and North Carolina.

Rot (*Penicillium glaucum* Lk.) was mentioned as the cause of decay of fruit in storage in Nebraska, Iowa, New Jersey, and Vermont.

Rust (*Gymnosporangium macropus* Lk., etc., I) was reported as of local occurrence near red cedar trees in Indiana, Iowa, Nebraska, Missouri, Arkansas, Tennessee, North Carolina, South Carolina, West Virginia, New Jersey, and Vermont.

Scab (*Venturia inaequalis* (Cke.) Aderh.) was unusually light over the whole eastern and central western parts of the United States. It was almost absent in Idaho, but was worse in the Sacramento Valley, California.

PEAR.—**Blight** (*Bacillus amylovorus* (Burr.) De Toni) was more prevalent in Connecticut, Massachusetts, New Jersey, Maryland, Virginia, Kentucky, and South Carolina. In New York it did more damage than for fifteen years. In Iowa and in Colorado and Idaho it was less prevalent. Spring weather conditions in California led to a large development of the disease there. Utah and Wyoming reported increased loss.

Leaf-blight (*Entomosporium maculatum* Lev.) was less prevalent in Ohio than in 1905. It was reported from New Jersey and West Virginia and was more severe in southern Georgia, but not in northern Georgia.

Leaf-spot (*Septoria piricola* Desm.) was reported from New York, Ohio, Missouri, and West Virginia, in the last two States causing much loss from defoliation.

Rust (*Gymnosporangium* sp. I) was reported from New Jersey.

Scab (*Venturia pirina* Aderh.) appears to have been less prevalent in New England, New York, Ohio, and Indiana. It was reported from Washington and, owing to spring rains, was in California still worse than in 1905.

QUINCE.—**Black-rot** (*Sphaeropsis malorum* Pk.) was less severe than usual in Ohio, Indiana, and West Virginia. Estimated loss, 6 to 10 per cent.

Blight (*Bacillus amylovorus* (Burr.) De Toni) occurred as usual or somewhat less. Reported from Indiana, Ohio, West Virginia, and North Carolina.

Leaf-spot (*Entomosporium maculatum* Lev.) caused serious defoliation of quinces in New Jersey, Ohio, West Virginia, and Missouri.

Rust (*Gymnosporangium* sp. I) was observed in North Carolina.

STONE FRUITS.

APRICOT.—**Brown-rot** (*Sclerotinia fructigena* (P.) Schrt.) caused considerable damage to young twigs of apricot in California.

CHERRY.—**Black-knot** (*Plowrightia morbosa* (Schw.) Sacc.) occurred as usual in New Jersey, Ohio, Indiana, and West Virginia, and is reported to have caused the abandonment of cherry raising in western North Carolina.

Brown-rot (*Sclerotinia fructigena* (P.) Schrt.) was less prevalent in New Jersey, Pennsylvania, Ohio, and Iowa; 25 per cent losses were reported from Missouri, and as high as 50 per cent from New York, sweet cherries suffering most. It was reported on *Prunus besseyi* in Nebraska.

Leaf-spot (*Cylindrosporium padi* Karst.) was less prevalent in Ohio, Indiana, Nebraska, and Iowa. Serious defoliation was reported from western New York, northwestern Pennsylvania, Maryland, West Virginia, and Missouri.

Powdery mildew (*Podosphaera oxyacanthae* (DC.) De By.) was reported as occurring on young trees in Colorado, Ohio, Iowa, Nebraska, West Virginia, and Kentucky.

PEACH.—**Bacterial spot** (*Bacterium pruni* Erw. Sm.) caused defoliation in some cases in Georgia.

Black spot (*Cladosporium carpophilum* Thüm.) appears to have been more prevalent this year. It was reported common in Massachusetts, New Jersey, Maryland, Indiana, and Kentucky; destructive in West Virginia; in Ohio disfiguring 20 to 50 per cent of the fruit, in southern Missouri 70 per cent of the Elbertas, and in Nebraska 50 per cent of late peaches.

Brown-rot (*Sclerotinia fructigena* (P.) Schrt.) was very destructive this year. In Georgia it prevailed throughout the peach belt, causing losses of 10 to 50 per cent. In Virginia, Maryland, Delaware, New York, Ohio, southern Missouri, and northern Arkansas it was more serious.

Crown gall was reported this year only from Alabama, Florida, and Ohio.

Frosty mildew (*Cercosporella persicae* Sacc.) was reported from North Carolina and West Virginia as causing but little injury.

Gumming disease (*Coryneum beyerinckii* Oud.), which has been in California for several years, has been on the increase and has caused alarming losses the past three or four years. Early winter spraying, advised by Mr. M. B. Waite of this Department, has been found to completely control the disease. (Science, XXV, 304).

Leaf curl (*Exoascus deformans* (Berk.) Fckl.) was reported from Alabama, West Virginia, New York, Indiana, Nebraska, and Washington. It was more prevalent in Georgia, Iowa, and New Jersey, and less so in Maryland and Ohio.

Little Peach has spread at only a moderate rate in Michigan and New York.

Powdery mildew (*Sphaerotheca pannosa* (Wallr.) Lev., etc.) was reported more abundant in New York and in Colorado.

Pustular spot (*Helminthosporium carpophilum* Lev.) was less common this year in Ohio.

Rosette occurred to a considerable extent in southern Missouri and in Georgia.

Rust (*Puccinia pruni* P.) was reported as occurring to a slight extent in Ohio and North Carolina.

Yellows occurred from New England through New Jersey, Maryland, and Virginia to western North Carolina and eastern Tennessee, and west to Indiana and southern Illinois. The past year there has been an outbreak of unusual virulence in western Maryland and adjacent parts of Virginia and West Virginia, almost completely destroying many orchards.

PLUM.—**Black-knot** (*Plowrightia morbosa* (Schw.) Sacc.) occurred about as usual everywhere, from New England to North Carolina, Alabama, Tennessee, and Kentucky, and to Indiana and Minnesota, especially on the damson and wild plums.

Black-spot (*Cladosporium carpophilum* Thüm.) was more injurious in Iowa.

Brown-rot (*Sclerotinia fructigena* (P.) Schrt.) occurred as usual over most of the eastern and central United States. It was worse than usual in West Virginia, Ohio, Indiana, and Iowa, and serious in western Washington.

Leaf-spot (*Cylindrosporium padi* Karst.) caused early defoliation, followed in some cases by fall blossoming in West Virginia and Missouri. It injured 20 to 80 per cent of the crop in Ohio, but was reported less prevalent in Indiana and Iowa.

Plum-pockets (*Exoascus pruni* Fckl.) was reported as occurring to an unimportant extent in North Carolina, New Jersey, Ohio, Iowa, Nebraska, Wisconsin, and North Dakota.

Rust (*Puccinia pruni* P.) was reported from Georgia and Missouri as unimportant.

SMALL FRUITS.

BLACKBERRY.—**Anthracnose** (*Gloeosporium venetum* Speg.) prevailed to the usual extent in Ohio and Indiana.

Crown-gall was reported from one locality in Ohio.

Leaf-spot (*Septoria rubi* Westd.) was reported from Ohio, Indiana, Nebraska, and West Virginia.

Rust (*Gymnoconia interstitialis* (Schl.) Lagh.) was common and in some cases destructive in California, Florida, Indiana, Missouri, New Jersey, Ohio, and West Virginia.

CRANBERRY.—**Anthracnose** did considerable damage in some localities in Massachusetts.

Exobasidium vaccinii (Fckl.) Wor. caused serious injury in Massachusetts.

Scald was more severe in New Jersey on account of excessive rains.

CURRANT.—**Anthracnose** (*Gloeosporium ribis* (Lib.) Mont. & Desm.) was reported from Ohio.

Cane-blight (*Nectria cinnabarina* (Tode) Fr.) was reported from Ohio.

Leaf-spot (*Cercospora angulata* Wint.) was reported from West Virginia, Ohio, and Iowa; (*Septoria ribis* Desm.) from Vermont, New Jersey, Ohio, and Nebraska. Considerable defoliation resulted in both cases.

Powdery mildew (*Sphaerotheca mors-uvae* (Schw.) B. & C.) was reported from Ohio, Nebraska, and Washington.

Rust (*Cronartium ribicolum* Dietr.) was reported for the first time from New York by F. C. Stewart.

GOOSEBERRY.—**Leaf-spot** (*Septoria ribis* Desm.) was reported slight in Ohio, Indiana, Nebraska, and West Virginia.

Powdery mildew (*Sphaerotheca mors-uvae* (Schw.) B. & C.) was prevalent in New Jersey, Ohio, Indiana, Nebraska, North Dakota, and Washington.

GRAPE.—**Anthracnose** (*Sphaceloma ampelinum* De By.) was reported from New Hampshire, West Virginia, and Ohio.

Black-rot (*Guignardia bidwellii* (Ell.) V. & R.) was almost absent this year from the Lake Erie region of New York and Pennsylvania, but in central New York and the Sandusky region of Ohio there was great loss, as was also the case in southwestern Michigan, where the loss was estimated at 30 to 40 per cent. It was more prevalent in Connecticut, Delaware, Maryland, Florida, and Indiana, and injurious in New Jersey, North Carolina, West Virginia, Kentucky, Missouri, and Nebraska.

Downy mildew (*Plasmopora viticola* (B. & C.) Berl. & De T.) did a slight amount of damage in Vermont, New Hampshire, New York, Maryland, Ohio, West Virginia, Kentucky, Missouri, and Nebraska.

Powdery mildew (*Uncinula necator* (Schw.) Burr.) was very injurious in Florida, and of occasional occurrence in Colorado, Iowa, Ohio, West Virginia, and Pennsylvania.

PERSIMMON.—**Anthracnose** (*Gloeosporium diospyri* E. & E.) was reported as of occasional occurrence in West Virginia.

RASPBERRY.—**Anthracnose** (*Gloeosporium venetum* Speg.) was troublesome in Ohio and New York, and reported from Indiana, Iowa, Wisconsin, Nebraska, Kentucky, Maryland, New Hampshire, and Washington.

Crown-gall was reported to be the cause of serious loss in Delaware, Ohio, and Nebraska.

Leaf-spot (*Septoria rubi* Westd.) was common but unimportant in Ohio, Indiana, West Virginia, Missouri, and Nebraska.

Rust (*Gymnoconia interstitialis* (Schl.) Lagh.) was locally injurious in Indiana, Ohio, West Virginia, Iowa, and New York. A rust due to *Kühneola albida* Magn. was reported from West Virginia.

Wilt (*Leptosphaeria coniothyrium* (Fckl.) Sacc.) was injurious in Connecticut, and was reported from Ohio.

STRAWBERRY.—**Leaf-spot** (*Sphaerella fragariae* (Tul.) Sacc.) was common in the eastern and central States and in Washington.

TROPICAL FRUITS.

AVOCADO.—**Anthracnose** (*Colletotrichum gloeosporiodes* Penz.) blighted 50 to 75 per cent of the blossoms in southern Florida.

CITRUS FRUITS.—**Anthracnose** or **Wither-tip** (*Colletotrichum gloeosporioides* Penz.) caused heavy losses in Florida, the blossom blight of limes taking in some cases 75 to 100 per cent of the crop. Wither-tip has been common, though successfully controlled by proper treatment. The same fungus has injured the fruit of oranges and pomelos.

Blight prevailed as usual in Florida.

Die-back has become much less prevalent on account of the more rational use of fertilizers.

Root-rot (*Fusarium limonis* Briosi) was prevalent in Florida in undrained soils on account of the heavy rainfall.

Scab (*Cladosporium* sp.) was much more prevalent in all sections of Florida.

Brown-rot (*Pythiacystis citrophthora* Sm. & Sm.), a new disease which has caused much loss to California lemons during storage, has been worked out by R. E. and E. H. Smith of the California Station (Bot. Gaz., xlii, 215).

GUAVA.—**Ripe-rot** (*Glomerella psidii* (G. Del.) Sheldon), a disease hitherto undescribed, has been studied by Dr. J. L. Sheldon (West Virginia Station Bulletin 104) from material collected in a greenhouse in Washington, D. C. It occurs in Florida, Porto Rico, and other tropical countries.

MANGO.—**Anthracnose** (*Colletotrichum gloeosporioides* Penz.) occurred in Florida as blossom blight, fruit rot, wither-tip, etc., according to the part of the plant attacked. Heavy losses resulted, but careful spraying was found to control the trouble.

PINEAPPLE.—**Pineapple disease** (*Thielaviopsis ethaceticus* Went.) caused considerable injury in Hawaii.

VEGETABLE AND FIELD CROPS.

ASPARAGUS.—**Rust** (*Puccinia asparagi* DC.) now occurs in every State where asparagus is grown and continues to do much damage, particularly in the Central and Western States. During 1906 it appears to have been less prevalent than heretofore in the East.

BEAN.—**Anthracnose** (*Colletotrichum lindemuthianum* (Sacc. & Magn.) Bri. & Cav.) was very serious in Florida and prevailed generally in the Atlantic States, though it was not as bad as last year. In New England and New York it caused exceptionally heavy losses of beans grown for canning, but was less injurious to the later crop of dry beans. The loss in Ohio was estimated at 20 per cent.

Bacteriosis (*Bacterium phaseoli* Erw. Sm.) was reported from New York, New Jersey, Nebraska, and Vermont.

Downy mildew (*Phytopthora phaseoli* Thax.) was less injurious in Connecticut than last year. It was quite prevalent in Delaware, Maryland, New Jersey, and Pennsylvania.

Leaf spots (*Phyllosticta phaseolina* Sacc. and *Isariopsis griseola* Sacc.) occurred in West Virginia.

Powdery mildew (*Erysiphe polygoni* DC.) was less prevalent in Ohio.

Rust (*Uromyces appendiculatus* (P.) Lev.) was reported from Indiana, New Jersey, Ohio, West Virginia, Pennsylvania, and Kentucky and was abundant in California.

BEET.—**Curly-top** of sugar beets did considerable injury in local areas in California, but was less prevalent in Colorado, Utah, and Texas.

Leaf-blight (*Cercospora beticola* Sacc.) appeared later than usual, but was nevertheless destructive to sugar beets from Nebraska eastward, particularly in fields previously planted to sugar beets. It was more noticeable in Colorado than formerly. *Phyllosticta betae* Oud. was reported from Colorado and North Carolina.

Rhizoctonia root-rot occurred to a slight extent in Colorado, Iowa, and Michigan.

CABBAGE.—**Black-rot** (*Bacterium campestris* (Pam.) Erw. Sm.) appears to have been generally prevalent, and in some cases quite injurious, according to reports from Delaware, Indiana, Iowa, Nebraska, Kentucky, Louisiana, Maryland, New Jersey, New York, North Carolina, Ohio, South Carolina, Vermont, and Washington.

Club-root (*Plasmodiophora brassicae* Wor.) is everywhere increasing. It was reported this year from New Hampshire, New York, New Jersey, North Carolina, Ohio, Vermont, Washington, and West Virginia.

Root-knot (*Heterodera radicicola* (Greef.) Mül.) was sent in from Texas.

Wilt (*Fusarium*) continues to do injury in old gardens in North Carolina.

CANTALOUPE.—**Anthracnose** (*Colletotrichum lagenarium* (Pass.) Ell. & Hals.) prevailed in Indiana, Nebraska, New Jersey, and West Virginia.

Downy mildew (*Pseudoperonospora cubensis* (B. & C.) Rost.) injured the crop to a slight extent in Ohio and Vermont.

Leaf-blight (*Alternaria brassicae* var. *nigrescens* Pegl.) was again the cause of marked injury, especially in the large cantaloupe-growing sections. It was reported from Colorado, Connecticut, Delaware, Florida, Indiana, Maryland, New York, North Carolina, Ohio, Tennessee, and West Virginia.

Root-knot (*Heterodera radicicola* (Greef.) Mül.) was reported from North Carolina.

Wilt (*Bacillus tracheiphilus* Erw. Sm.) was reported from Massachusetts, Ohio, and Indiana.

Wilt (*Fusarium*) was reported from Arizona.

CAULIFLOWER.—**Black-rot** (*Bacterium campestris* (Pam.) Erw. Sm.) was injurious locally in Louisiana and Ohio.

CELERY.—**Leaf-blight** (*Cercospora apii* Fres.) occurred in Florida, where 80 per cent of the crop was injured; also in Delaware, Georgia, New Jersey, New Hampshire, Ohio, and Nebraska.

Leaf-spot (*Septoria petroselini* Desm. var. *apii* Br. & Cav.) was reported from Delaware, New York, and Ohio.

COLLARDS.—In North Carolina collards were attacked by *Alternaria brassicae* (Berk.) Sacc., *Peronospora parasita* (Pers.) De By., *Bacterium campestris* (Pam.) Erw. Sm., *Fusarium* sp. and *Plasmodiophora brassicae* Wor.

CUCUMBER.—**Anthracnose** (*Colletotrichum lagenarium* (Pass.) Ell. & Hals.) occurred in Ohio, where the injury is estimated at 25 to 60 per cent of the crop, and in New Jersey, North Carolina, West Virginia, Nebraska, and Wisconsin.

Downy mildew (*Pseudoperonospora cubensis* (B. & C.) Rost.) occurred in Florida to a serious extent. The disease prevails through the winter there and attacks the young plants. Some injury was reported from Massachusetts, Connecticut, and New Jersey, while in Maine, New Hampshire, and Ohio there was a serious epidemic in August.

Wilt (*Bacillus tracheiphilus* Erw. Sm.) was reported from Massachusetts, New Jersey, New York, Ohio, Pennsylvania, and Norfolk, Va.

EGGPLANT.—**Fruit-rot** and **Leaf-spot** (*Phyllosticta hortorum* Speg.) was prevalent in New Jersey and on Long Island.

GINSENG.—**Alternaria blight** has been destructive in New York as in preceding years, causing some plantations to be abandoned. Prof. H. H. Whetzel, of Cornell University, reports complete control through spraying with Bordeaux mixture.

Root-rot and **Stem-rot** (*Rhizoctonia* sp.) were reported by Whetzel from New York, Virginia, and Wisconsin. Another disease of the stem due to *Phytopthora cactorum* (Cohn. & Leb.) Schrt. has been found by J. M. Van Hook of the Ohio station in both Ohio and New York.

LETTUCE.—**Drop** (*Sclerotinia libertiana* Fckl.) was very injurious in the Atlantic States, especially in cold frames and greenhouses. Florida growers suffered losses in many cases of 70 to 100 per cent, and the disease was severe in Georgia, North Carolina, Delaware, Ohio, and Alabama.

Leaf-mold (*Botrytis cinerea* P.) was reported from Florida and North Carolina as of minor importance.

Leaf-spot (*Septoria consimilis* Ell. & Mart.) was reported from New York and North Carolina.

Root-knot (*Heterodera radicicola* (Greef.) Mul.) was the cause of complaint in Texas.

Rosette (*Rhizoctonia* sp.) and **Tipburn** were also mentioned in Ohio.

ONION.—**Anthracnose** (*Vermicularia circinans* Berk.) did considerable injury in New York.

Downy mildew (*Peronospora schleideniana* De By.) was reported from Colorado, New York, Ohio, and Vermont. It appears to have been less prevalent than last year.

Smut (*Urocystis cepulae* Frost) was reported from Connecticut, Massachusetts, and Ohio. In Ohio the formalin soil treatment continues to prevent the disease, but some thousands of dollars were lost on untreated fields in the Scioto Valley.

PEA.—**Powdery mildew** (*Erysiphe polygoni* DC.) caused injury in New Hampshire, especially on late peas, and in Iowa, Ohio, Nebraska, and West Virginia.

Ascochyta blight (*Ascochyta pisi* Lib.) was somewhat less injurious in Ohio but worse in New York, injuring 50 to 80 per cent of the crop in some fields. It was also reported

from New Jersey. J. M. Van Hook has shown in Bulletin 173 of the Ohio Station that the epidemic in that State the past three years has been largely due to seed infection.

POTATO.—**Brown-rot** (*Bacterium solanacearum* Erw. Sm.) occurred to a slight extent in the District of Columbia, Maryland, Ohio, Indiana, Nebraska, and Washington.

Dry-rot (*Fusarium oxysporum* Schlecht). Reports of local losses came from New York, Ohio, and Vermont this year.

Early blight (*Alternaria solani* (E. & M.) J. & G.) was somewhat less prevalent on the early crop in Florida and other South Atlantic States, but was more injurious northward on the main crop. Most of the injury to potatoes this year from New England and New York to Wisconsin was due to this disease, as the dry season favored it. The crop in Wisconsin is estimated to have been reduced 4 to 6 million bushels by it. Its occurrence was noted in Utah and Washington. Great loss, estimated at 50 per cent of the crop, was reported from Wyoming.

Leaf-blotch (*Cercospora concors* (Casp.) Sacc.), a new disease of minor importance, has been found in Vermont for two years and is described by Prof. L. R. Jones in the Report of the Vermont Station for 1906.

Late-blight (*Phytophthora infestans* De By.) was for the first time in six years held in check by dry autumn weather. It was somewhat harmful in Florida in May and developed on Long Island and in New England in June and July. Dry weather later prevented its spread and the losses in the great potato sections were small compared with those of previous years. All potato diseases were controlled in Maine by the general spraying practiced there during the past few years and good results were reported in other states. Late blight was reported injurious in western Washington.

Scab (*Oospora scabies* Thax.) was in most cases reported less injurious the past season. In Maine and in other States where the danger of soil infection has not been considered, an increase has been observed. The estimated injury in Nebraska was 15 per cent.

Rhizoctonia disease (*Corticium vagum* B. & C. var. *solani* Burt.) caused heavy losses in portions of Colorado and Wyoming and was reported from Arizona. It was less common this year in Florida, Ohio, and the Eastern States.

SALSIFY—**Root-knot** (*Heterodera radicicola* (Greef.) Mul.) was injurious in one locality in North Carolina.

White rust (*Cystopus tragopogonis* Tul.) was reported from Nebraska.

SQUASH—**Bacterial wilt** (*Bacillus tracheiphilus* Erw. Sm.) was reported from New York. A Fusarium wilt occurred in Arizona.

SUGAR CANE—Dr. N. A. Cobb has issued from the Hawaiian Sugar Planters' Experiment Station, Bulletin No. 5 on Fungus Maladies of the Sugar Cane, an important monograph. The prevalence of the diseases mentioned for 1906 is given by Doctor Cobb as follows:

Eleau caused small losses, estimated at less than 1 per cent.

Pineapple disease (*Thielaviopsis ethaceticus* Went.) prevailed about as usual, causing losses varying from 1 to 10 per cent.

Rind disease (*Melanconium* sp.) was less prevalent, though losses in some cases amounted to 25 per cent.

Root disease (*Ithyphallus coralloides* Cobb.) destroyed 10 per cent of the crop in the worst districts, but, following the discovery of the parasite, good results have come from the treatment advised. Root disease (*Marasmius sacchari* Wak.) was somewhat more prevalent, the loss being estimated as high as 10 per cent of the ratoon crop.

Leaf-splitting disease (*Mycosphaerella striatiformans* Cobb.), a serious trouble, has been found by Doctor Cobb to be due to the fungus named.

SWEET POTATOES.—The following diseases were reported from the States named. Their actual distribution is no doubt more general.

Black-rot (*Ceratocystis fimbriata* Ell. & Hals.), Alabama, Ohio, Tennessee.

Dry-rot (*Phoma batatae* Ell. & Hals.), Alabama, Tennessee.

Leaf-spot (*Phyllosticta bataticola* Ell. & Mart.), North Carolina.

Soft-rot (*Rhizopus nigricans* Ehrb.) Alabama, North Carolina, Maryland, very bad.

Soil-rot (*Acrocystis batatas* Ell. & Hals.), Alabama.

Stem-rot (*Nectria ipomoeae* Hals.), Ohio.

White-rot (*Penicillium* sp.), Alabama, serious.

White-rust (*Cytopus ipomoeae-panduranae* (Schw.) Farl.), Georgia.

TOBACCO.—**Bed-rot** (*Rhizoctonia* sp.) prevailed as usual in Ohio, the estimated loss being 7 per cent. Dr. A. D. Selby, at the Ohio station, finds soil treatment with formalin to assist in its control.

Broom-rape (*Orobanche ludoviciana* Nutt.) occurred in very local areas in Ohio.

Mosaic disease was troublesome in the Chemung Valley, New York, but less common in Ohio.

Root-rot (*Thielavia basicola* Zopf.) was quite injurious to tobacco seedlings in Connecticut and to a lesser extent in Ohio.

Wilt, bacterial.—The Granville wilt in North Carolina was estimated as 40 per cent more destructive than last year, causing a loss of $20,000.

TOMATO—**Anthracnose** (*Colletotrichum phomoides* (Sacc.) Chest.) was reported from New Jersey, New York, Ohio, and North Dakota.

Blight (*Bacterium solanacearum* Erw. Sm.) was reported from New Jersey, North Carolina, and Alabama.

Leaf-mold (*Cladosporium fulvum* Cke.) caused complaint in New Hampshire.

Leaf-spot (*Septoria lycopersici* Speg.) was prevalent in Delaware, Maine, Maryland, Nebraska, New Jersey, New York, and West Virginia. (*Alternaria solani* (E. & M.) J. & G.) was reported as of minor importance in Maine, Ohio, and West Virginia.

Point-rot was more destructive than usual in California and in New York and Vermont, but less so in Ohio. It was reported from Alabama, Maine, and West Virginia.

Root-knot (*Heterodera radicicola* (Greef.) Mül.) was injurious in Arizona and Florida.

Western blight was much less prevalent in Utah this year, but was bad in Washington, causing losses of 35 to 90 per cent, and in Colorado.

Wilt (*Fusarium* sp.) caused losses of 25 per cent in portions of Arizona and Louisiana. It is widely prevalent in Florida, but losses are avoided there by rotation of crops. It was less abundant in California.

TURNIP.—**Black-rot** (*Bacterium campestris* (Pam.) Erw. Sm.) caused unimportant injuries in Ohio.

Club-root (*Plasmodiophora brassicae* Wor.) was this year reported on this host only from Ohio and New Jersey.

WATERMELON.—**Anthracnose** (*Colletotrichum lagenarium* (Pass.) Ell. & Hals.) was epidemic in the Ohio Valley, especially in West Virginia. It was reported also from Nebraska, Indiana, Ohio, Rhode Island, and South Carolina.

Downy mildew (*Pseudoperonospora cubensis* (B. & C.) Rost.) was observed in Ohio.

Leaf-spot (*Cercospora citrulina* Cke.) was reported to occur to a slight extent in West Virginia.

Wilt (*Neocosmospora vasinfecta var. nivea* Erw. Sm.) occurred as usual in the South Atlantic States from Florida to Virginia.

CEREALS.

BARLEY.—**Mildew** (*Erysiphe graminis* DC.) was reported injurious to beardless barley in one locality in New York.

Rust (*Puccinia graminis* P.) was as usual widely distributed, but not injurious to the crop.

Covered smut (*Ustilago hordei* (P.) Kell. & Sw.) prevailed as usual in Iowa, Minnesota, North Dakota, and neighboring States.

Loose smut (*Ustilago nuda* (Jens.) Kell. & Sw.) was widely distributed and injurious. The loss was estimated at 7 to 10 per cent in Wisconsin and Minnesota and appears to be increasing.

Yellow-leaf (*Helminthosporium gramineum* Rbh.) was more prevalent in Iowa, attacking probably 1 per cent of the crop.

CORN.—**Leaf-blight** (*Helminthosporium inconspicuum* C. & E.) was locally abundant in Maryland, Ohio, and West Virginia.

Mold (a sterile fungus) injured 5 to 50 per cent of the mature crop in North Carolina.

Rust (*Puccinia sorghi* Schw.) is widely distributed, but seldom injurious. One case of severe loss was reported from Vermont.

Smut (*Ustilago zeae* (Beckm.) Unger) occurred everywhere. The average loss for the whole country was 1 to 2 per cent of the total crop. It was especially prevalent last year in North Dakota. The losses in Nebraska were estimated at 2 to 10 per cent.

MILLET.—**Smut** (*Ustilago crameri* Körn.) was of slight occurrence in Ohio and Minnesota.

OATS.—**Rusts** (*Puccinia graminis* P. and *P. coronata* Cda.) occurred about as usual or a little less, the late varieties as usual suffering most.

Smut (*Ustilago avenae* (P.) Jens.) occurred everywhere as usual, but appeared to be relatively worse in the South (12 per cent in North Carolina). In the northern Mississippi Valley seed treatment is more generally applied. The loss in Wisconsin was estimated at 5 per cent. Reports of loss come from western Washington also.

RICE.—**Black smut** (*Tilletia horrida* Tak.) was reported from two localities in Louisiana.

Blast was almost absent in South Carolina this year, the season being very wet. It occurred locally in Texas.

Green smut (*Ustilaginoidea virens* (Cke.) Tak.) has been known to occur in this country for five years, but only to a slight extent. It appears, however, to be on the increase.

RYE.—**Ergot** (*Claviceps purpurea* (Fr.) Tul.) was reported from Ohio and Minnesota.

Rusts (*Puccinia rubigo-vera* (DC.) Wint. and P. *graminis* P.), though everywhere present, do no serious damage.

SORGHUM.—**Blight** (*Bacillus sorghi* Burr.) caused losses estimated in Iowa and Ohio at about 5 per cent. Reported from Nebraska.

Smut (*Sphacelotheca sorghi* (Link.) Clint.) has assumed serious proportions in Kansas, Oklahoma, and the Texas Panhandle and is rapidly spreading. *S. reiliana* (Kühn) Clint.) was widely distributed, but not in serious quantity.

WHEAT.—**Leaf-blight** (*Leptosphaeria tritici* Pass.) was reported from Nebraska.

Leaf-rust (*Puccinia rubigo-vera* (DC.) Wint.) was quite destructive in the northern Mississippi Valley and the southern Great Plains region, the injury being estimated by Prof. H. L. Bolley at 10 per cent in North Dakota.

Stem-rust (*Puccinia graminis* P.) was less injurious than usual in nearly all the wheat-growing States.

Scab (*Fusarium culmorum* (W. G. Sm.) Sacc.) appears to have been much less prevalent this year.

Loose smut (*Ustilago tritici* (P.) Jens.) is widely distributed and increasing in the Eastern and Middle Western States.

Stinking smut (*Tilletia foetans* (B. & C.) Tul.) was widespread and abundant, especially where seed wheat was not treated. The estimated loss in Arizona was 5 to 15 per cent; in Indiana, 2 per cent; in Washington, 10 to 15 per cent.

FORAGE CROPS.

ALFALFA.—**Bacterial blight**, a new disease, reported by Prof. W. Paddock, in Press Bulletin 28, of the Colorado station, was first seen there in 1903, but is now more abundant, and has also appeared in Utah and Kansas.

Anthracnose (*Colletotrichum trifolii* B. & E.) was reported from Tennessee.

Dodder (*Cuscuta epithymum* Murr., etc.) has become quite widely distributed with the extension of alfalfa culture, but its dangerous character is more generally recognized and control measures adopted.

Leaf-spot (*Pseudopeziza medicaginis* (Lib.) Sacc.) was reported more injurious in New York, New Jersey, and Wyoming. Most States where alfalfa is grown report this disease, but not as a serious one.

Root-rot was worse than usual in northern Texas, where the injury was considerable, but less common in Arizona.

Rust (*Uromyces striatus*) was reported from Nebraska.

CLOVER.—**Anthracnose** (*Colletotrichum trifolii* B. & E.) is generally distributed over Tennessee and is common in West Virginia. *Gloeosporium caulivorum* Kirch. was also reported from West Virginia.

Dodder (*Cuscuta epithymum* Murr.) occurred on clover much as on alfalfa.

Black-spot (*Phyllachora trifolii* (P.) Fckl.), a minor disease, was mentioned only in reports from Iowa, Kentucky, and West Virginia.

Leaf-spot (*Macrosporium sarcinaeforme* Cav.) was injurious to young clover in West Virginia.

Root-knot (*Heterodera radicicola* (Greef) Müll.) has been found by Dr. J. L. Sheldon to be widely distributed in the Ohio valley of West Virginia.

Rust (*Uromyces trifolii* (A. & S.) Wint.) was reported as a minor trouble in Indiana, Iowa, Kentucky, Maryland, and West Virginia.

COWPEA.—**Root-knot** and **Wilt** (*Heterodera radicicola* (Greef) Müll. and *Neocosmospora vasinfecta* var. *tracheiphila* Erw. Sm.) prevailed as usual in sandy soils from North Carolina to Florida and west to Texas.

FIBER PLANTS.

COTTON.—**Angular leaf-spot** and **Blackarm** (*Bacterium malvacearum* Erw. Sm.) was generally distributed through the cotton belt, though less prevalent than in 1905.

Anthracnose (*Colletotrichum gossypii* Southw.) was injurious locally in several States, especially in western Georgia.

Texas root-rot was worse in central and northern Texas than ever before, causing very heavy losses.

Wilt (*Neocosmospora vasinfecta* (Atk.) Erw. Sm.) is increasing in the Coastal Plain from North Carolina to Florida and westward to Louisiana, and has also been found in Tennessee, Missouri, and Indian Territory.

FLAX.—**Wilt** (*Fusarium lini* Bolley) and the associated troubles, **Anthracnose** (*Colletotrichum* sp.) and **Boll disease** (*Alternaria* sp.), prevailed as usual in Minnesota and North Dakota, though progress is being made in securing the adoption by farmers of methods of treatment.

NUT, FOREST, AND SHADE TREES.

The following diseases have been reported as indicated:

ASH.—**Rust** (*Puccinia fraxinata* (Lk.) Arth.) was reported from Nebraska as less common.

BALM OF GILEAD.—**Leaf-spot** (*Septoria populicola* Pk.) was reported from Nebraska.

Rust (*Melampsora populina* (Jcq.) Lev.) was reported from Nebraska and West Virginia.

BLACK WALNUT.—**Leaf-spot** (*Marsonia juglandis* (Lib.) Sacc.) was reported from West Virginia, New Jersey, and Iowa, and as much more prevalent in Nebraska.

CATALPA.—**Leaf-spot** (*Phyllosticta catalpae* E. & M.) was reported from West Virginia as destructive to foliage of young trees.

CEDAR.—**Rust** (*Gymnosporangium macropus* Lk.) was reported from Nebraska, New Jersey, Iowa, and West Virginia.

COTTONWOOD.—**Crown-gall** was reported from Wyoming. (15th Report Wyoming Expt. Sta., p. 33.)

Rust (*Melampsora populina* (Jcq.) Lev.) was reported from Nebraska, Iowa, and North Dakota.

CHESTNUT.—**Anthracnose** (*Marsonia ochroleuca* (B. & C.) Humph.) was reported from West Virginia.

DOGWOOD.—**Leaf-spot** (*Septoria cornicola* Desm.) was reported from Nebraska.

ELM.—**Black-spot** (*Dothidella ulmi* (Duv.) Wint.) was reported from Nebraska and New Jersey; and *Gnomonia ulmea* (Sacc.) Thüm., from Nebraska.

HONEY LOCUST.—**Black-leaf** (*Leptostroma hypophyllum* B. & Rav.) was reported from Nebraska.

HORSE CHESTNUT.—**Leaf-spot** (*Phyllosticta paviae* Desm.) was reported from West Virginia.

KENTUCKY COFFEE TREE.—**Leaf-spot** (*Cercospora gymnocladi* Ell. & Kell.) was reported from Nebraska.

MAPLE.—**Leaf-spot** (*Rhytisma acerinum* (P.) Fr.) was reported from Iowa, Kentucky, New Jersey, and Nebraska.

MULBERRY.—**Leaf-spot** (*Cercospora moricola* Cke.) was reported from Nebraska.

PECAN.—**Powdery mildew** (*Microsphaera alni* (Wallr.) Salmon) was reported from Georgia and Florida as of little importance.

Rosette was reported from South Carolina, Georgia, Florida, and Alabama as a serious disease.

Scab (*Fusicladium effusum* Wint.) was more injurious this year in South Carolina, Georgia, Florida, Alabama, and Louisiana.

PINE.—**Rust** (*Coleosporium senecionis* (P.) Fr.) was reported from Connecticut, Minnesota, and Georgia.

Seedling blight (*Cladosporium herbarum* (P.) Lk.) was reported from Nebraska.

PRIVET.—**Anthracnose** (*Gloeosporium cingulatum* Atk.) was reported from Ohio.

SASSAFRAS.—**Red heart-rot** (*Fomes ribis* (Schum.) Fr.) has been found by Dr. P. Spaulding to be common around St. Louis, Mo.

WILLOW.—**Black-spot** (*Rhytisma salicinum* Fr.) was reported from Nebraska.

Rust (*Melampsora* sp.) was reported from Iowa and West Virginia; *M. farinosa* (P.) Schrt. on *Salix amygdaloides*, from Nebraska.

ORNAMENTAL PLANTS.

ASTER.—**Wilt** (*Fusarium* sp.) was more prevalent in Massachusetts.

Yellows was more prevalent again in Vermont and Massachusetts.

CARNATION.—**Rust** (*Uromyces caryophyllinus* (Schrank.) Schrt.) occurred to a slight extent in Iowa and North Carolina.

Spot (*Alternaria* sp.) has been reported from Maryland, the District of Columbia, Pennsylvania, and Connecticut.

Stem-rot (*Fusarium* sp.) was reported from North Carolina and New York, and (*Rhizoctonia* sp.) from Ohio.

Stigmonose was found in Indiana and Rhode Island.

CHRYSANTHEMUM.—**Leaf-spot** (*Septoria chrysanthemi* Cav.) and **Rust** (*Puccinia chrysanthemi* Roze.) were prevalent in North Carolina and New Jersey.

Petal-rot (*Botrytis vulgaris* Fr.) was found by Dr. P. Spaulding to be quite prevalent on exhibition plants in St. Louis. The same fungus also destroyed Poinsettias in greenhouses.

HOLLYHOCK.—**Leaf-blight** (*Cercospora althaeina* Sacc.) was reported from West Virginia and Nebraska.

Rust (*Puccinia malvacearum* Mont.) was destructive in New York, Massachusetts, New Jersey, Pennsylvania, and West Virginia; also on *Malva* sp. in Colorado.

LILAC.—**Powdery mildew** (*Microsphaeria alni* (Wallr.) Salmon) was reported from New York, Iowa, Kentucky, and West Virginia.

PEONY.—**Leaf-spot** (*Cladosporium paeoniae* Pass.) was reported from New Jersey.

ROSE.—**Leaf-blotch** (*Actinonema rosae* (Lib.) Fr.) was reported from Pennsylvania, Kentucky, West Virginia, and Nebraska.

Powdery mildew (*Sphaerotheca pannosa* (Wallr.) Lev.) was very prevalent throughout the Eastern, Southern, and Central States and was reported from Colorado.

Rust (*Phragmidium subcorticium* (Schrank) Wint.) was reported from California, West Virginia, and Nebraska; and *P. mucronatum* from Iowa.

VIOLET.—**Leaf-spot** (*Cercospora violae* Sacc.) did some injury in North Carolina.

Marsonia violae (Pass.) Sacc.) was reported from Connecticut for the first time.

VIRGINIA CREEPER.—**Leaf-spot** (*Cercospora ampelopsidis* Peck.) was reported from Nebraska.

Powdery mildew (*Uncinula necator* (Schw.) Burr.) was reported from Nebraska.

THE PRINCIPAL INJURIOUS INSECTS OF 1906.

Prepared in the Bureau of Entomology.

In accordance with the plan adopted in 1905, the records of the principal injurious insects of the year 1906 are arranged in relation to food plant or host. The reports for the subject covered by each division or section of the Bureau have in each case been prepared by the expert in charge and cover not only the records made directly by the Department, but all the records available for the year.

In connection with these annual reports it should be noted that for the great mass of injurious insects the conditions are substantially uniform one year with another. In the case of certain insects, however, there are notable local outbreaks here and there which, as with some of the big grain pests, may become very widespread and amount to a considerable disaster to the crop. Any unusual local abundance or new form of injury, or any new pest, is very apt to be reported to this office or to the entomologist of the experiment station. On the other hand, familiarity with any pest, and with the remedy for it, soon leads to a cessation of reports; yet this does not necessarily indicate any diminution in the numbers of the pest nor its disappearance. The list could be very greatly extended if all the injurious insects of the year were included, but an attempt has been made to limit it to insects which have been rather more prominent than ordinarily.

The insects affecting the great staples, such as the Hessian fly, chinch bug, boll weevil, corn worm, or bollworm, San Jose scale, and codling moth, must necessarily be the cause, one year with another, of the greatest monetary loss, and no new insect, unless it at once affects a great staple, will ever compete with these in this respect. Such newcomers, however, are likely to appear at any time, as is illustrated by the boll weevil. The past year has witnessed minor losses from a number of insects which have not previously been of serious economic importance. Such are the Mexican bean weevil, the asparagus miner, the splitworm of tobacco, an Oriental moth attacking shade and fruit trees in Connecticut, a sawfly injurious to the leaf stems of maple, and a related species affecting the foliage of fruit trees.

INSECTS INJURIOUS TO COTTON AND OTHER SOUTHERN FIELD CROPS.

The area infested by the cotton boll weevil (*Anthonomus grandis* Boh.) was greatly increased during 1906. The eastern limit of infestation was extended to within about 20 miles of the Mississippi River, and on the north a considerable portion of southeastern Oklahoma has become infested. While the damage inflicted was not as heavy as during previous seasons, the resultant loss probably exceeded that of 1905 by about $2,000,000, making an estimated total of approximately $20,000,000. In the central and southern portions of Texas unusually dry weather during the growing season greatly reduced the number of weevils. On the whole, the season of 1906 was one of rather abnormal freedom from weevil damage.

The total loss due to the ravages of the bollworm (*Heliothis obsoleta* Fab.) probably did not exceed that of the preceding year and, as usual, was confined mainly to Texas, Oklahoma, and Louisiana. The injury to cotton in the two northern tiers of counties of Texas westward from Lamar and Delta to Clay and Jack counties was exceptionally severe.

The cotton-leaf caterpillar (*Alabama argillacea* Hbn.) was abundant in Louisiana and portions of Texas. The defoliation of cotton late in the season, however, is beneficial rather than injurious in territory infested by the boll weevil.

The cotton aphis (*Aphis gossypii* Glov.) appeared very generally upon cotton in the spring, but the injury inflicted was less severe than in 1905 owing to the increase of its natural insect enemies.

The cotton square borer (*Uranotes melinus* Hbn.) seems to be increasing in numbers from year to year. This species is distributed over the entire cotton belt, but its injuries have been most felt in Texas and Oklahoma, and particularly in the northern portion of the territory infested by the boll weevil.

The garden webworm (*Loxostege similalis* Guen.) did considerable damage to young cotton in certain localities in northern Texas. Replanting was necessitated in some instances.

The cotton red spider (*Tetranychus gloveri* Bks.) was reported injuring cotton in central Alabama.

The cotton leaf-beetle (*Luperodes varicornis* Lec.) was reported from South Carolina and Georgia, where it inflicted slight local injury on cotton.

The cutworm (*Autographa rogationis* Guen.) injured the stand of cotton in certain localities in northeastern Texas by cutting off the young plants in the spring.

The cotton leaf-bug (*Calocoris rapidus* Say) was very abundant throughout Louisiana and eastern Texas, where it probably injured cotton to some extent by sucking sap from the cotton bolls.

The tobacco thrips (*Euthrips nicotianæ* Hinds) did considerable injury to cigar-wrapper tobacco grown under shade in Florida, southern Georgia, and eastern Texas. The injury was less, however, than during 1904, owing to greater precipitation during the past season.

The budworms of tobacco (*Heliothis obsoleta* Fab. and *Chloridea virescens* Fab.) rank with the thrips in amount of injury to cigar-wrapper tobacco in Florida.

The splitworm or leaf-miner of tobacco (*Phthorimæa operculella* Zell.) has come to be of economic importance during the past two years, owing to the infestation by it of cigar-wrapper tobacco. Its injuries have been confined principally to a single county of Florida.

Insects Injurious to Cereal and Forage Crops.

The Hessian fly (*Mayetiola destructor* Say) was not excessively abundant, except locally in the east, and on the Pacific coast, where it destroyed the wheat crop in some sections. Indeed, over large areas it scarcely appeared at all. In the central Atlantic States this was due to late seeding of wheat, made necessary by the extremely wet weather of August. In the spring-wheat regions of the Northwest the absence of the pest was due to the prevalence of parasites, notably Polygnotus, one or two species of which seem to control this pest so far as it is controlled by natural agencies. This parasite was introduced from North Dakota to western Kentucky and Tennessee in the spring of 1905. During 1906 it was abundant in the sections where it was introduced, and was repeatedly observed ovipositing in the eggs of the Hessian fly. The peculiar breeding habits of these insects render them of the utmost value, and this experiment indicates that they may be readily introduced from one section of the country into another perhaps thousands of miles distant.

The chinch bug (*Blissus leucopterus* Say) was excessively abundant in northern Texas, southwestern Kansas, and northern Ohio. The long and short-winged forms again appeared in the timothy meadows of northeastern Ohio and attacked grass lands in Florida.

The slender, red seed-corn ground beetle (*Clivina impressifrons* Lec.) did great damage in many sections in the corn belt by devouring the seed after it was planted and before it had sprouted.

The alfalfa fields in many sections of the arid regions of the West were seriously injured by several species of grasshoppers. In Wyoming one species (*Melanoplus differentialis* Thos.) was, in some instances, almost swept out of existence by a parasitic fly (*Sarcophaga georgina* Wied.). This fly deposited its eggs on the bodies of the grasshoppers and the maggots hatching from the eggs entered the bodies of the grasshoppers and destroyed them.

The wheat jointworm (*Isosoma tritici* Riley) continued excessively abundant in some parts of Ohio, Indiana, and Michigan, though several parasites appeared to be subjugating the pest. A new factor in its control was indicated by the gnawing of the insect galls on the stems of wheat and the destruction of the larvæ in the field, supposedly by the short-tailed shrew (*Blarina brevicauda*). It has been determined by breeding experiments that the passing of the grain through the threshing machine

results in the death of nearly all the larvæ. This enables the farmer, by cutting his grain as low as possible, to destroy great numbers of the pest and thus prevent their breeding in his fields another year.

The corn root-aphis (*Aphis maidi-radicis* Forbes) was unusually and destructively abundant in portions of Virginia and Maryland, as well as in the Middle West. In Maryland, where the injury amounted to almost a total loss, it was found that winter plowing offered an almost complete protection from attack.

The fall army worm (*Laphygma frugiperda* S. and A.) destroyed fields of German millet in Georgia, Kafir corn and sorghum in Texas, sugar cane in Louisiana, and beets in Wyoming. It was abundant in some parts of North Carolina.

A species of cutworm, not yet determined, destroyed hundreds of acres of wheat during late fall in Montana.

The sorghum webworm (*Celama* [*Nola*] *sorghiella* Riley) attacked sorghum in Texas, as did also another similar insect (*Batrachedra rileyi* Wals.). The former species also destroyed sorghum heads about Orange, Va., and attacked the heads of timothy at Arlington, Va.

Two species of billbugs (*Sphenophorus parvulus* Gyll. and *S. venatus* Say) did serious injury to timothy at Arlington, Va. Larvæ of Sphenophorus were observed attacking wheat in South Carolina and Kansas, and barley in the former State.

The wheat-head army worm (*Heliophila albilinea* Hbn.) attacked the heads of timothy in meadows in southern Minnesota, and the true army worm (*H. unipuncta* Haw.) did serious injury in some sections of Virginia and New Jersey.

Two cutworms (*Carneades tessellata* Harr. and *C. punctigera* Walk.) attacked oats in North Dakota, while a third (*C. messoria* Harr.) attacked corn, and a fourth (*Hadena devastatrix* Brace) attacked young growing wheat. *Carneades rubefactalis* Grote seriously injured grass lands in Montana.

The spring grain aphis (*Toxoptera graminum* Rond.) universally infested wheat and oat fields in the grain belt of Texas and Oklahoma during the fall. Its unusual abundance in this section rendered crop prospects for the following year very poor. Many Texas farmers discontinued planting oats during the fall on account of the destructiveness of this insect in those fields already planted.

The two northern grain aphides (*Macrosiphum granaria* Buck. and *M. cerealis* Kalt.) were excessively abundant in portions of South Dakota.

The common stalk borer (*Papaipema nitela* Guen.) attacked wheat in considerable numbers about Lawrence, Kans., in June, and generally, but to a less degree, about Richmond, Ind.

The smaller wheat stem-maggot (*Oscinis carbonaria* Loew) was excessively abundant in stems of wheat on the earliest of the experimental sowings of this Bureau at Marion, Pa.

INSECTS INJURIOUS TO VEGETABLE CROPS.

The common asparagus beetle (*Crioceris asparagi* L.) spread southward to Cincinnati, Ohio, and established itself in several counties of North Carolina, these representing the southernmost regions that have been invaded by the species.

The asparagus miner (*Agromyza simplex* Loew) was more injurious in 1906 than hitherto observed, and is now particularly troublesome in the principal asparagus-growing sections of New England, where it bids fair to become a pest of considerable importance. A lesser degree of injury was observed in Virginia and in California, and there is a probability of more or less general but unknown damage by this species in all asparagus regions.

The Mexican bean weevil (*Zabrotes* [*Spermophagus*] *pectoralis* Shp.) was identified with injury to table beans at Brownsville, Tex. The species has not hitherto been found within our borders. There is strong likelihood of its permanent establishment in southern Texas and elsewhere where the climate is subtropical.

The pea aphis (*Macrosiphum* [*Nectarophora*] *destructor* Johns.) was reported injurious to garden and sweet peas in single localities in New York, Virginia, and Illinois, and in isolated localities also in the truck area of Texas.

Webworms were troublesome locally on beets. The beet webworm (*Loxostege sticticalis* L.) was reported destructive in sugar-beet fields in portions of Colorado. Outbreaks of the garden webworm (*Loxostege similalis* Guen.) were observed in Texas, where beets and other vegetables were injured. The southern beet webworm (*Pachyzancla bipunctalis* Fab. [*Botis repetitalis* Grote]) was concerned in injury to table beets in Texas, where it occurred with the garden webworm which it resembles in the manner of injury.

The beet aphis (*Pemphigus betæ* Doane) was generally present in the beet fields of southern California and was reported quite destructive, as was the beet leaf-miner (*Pegomya vicina* Lint.); it was abundant also in Utah.

The rhubarb flea-beetle (*Psylliodes punctulata* Mels.) was very generally destructive to young plants of sugar beet in California, Utah, and Colorado, its ravages extending into British Columbia, where it caused the loss of many thousands of dollars in hop fields. It was also injurious to hops near Sacramento, Cal.

Cutworms devastated fields of sugar beet in Michigan.

The little negro bug (*Corimelaena pulicaria* Germ.) was very injurious to celery in northern Ohio. A somewhat similar species, *Cosmopepla carnifex* Fab., was injurious to potato in northern Maine.

The striped cucumber beetle (*Diabrotica vittata* Fab.) is always troublesome and the year 1906 was normal. The western 12-spotted cucumber beetle (*D. soror* Lec.) was reported the most destructive sugar-beet pest in portions of southern California. *D. balteata* Lec., which was injurious to vegetables in 1905 in Texas, again did damage in that State, particularly to horse beans and vetches. The related *D. picticornis* Horn accompanied it but did less injury.

The striped cabbage flea-beetle (*Phyllotreta vittata* Fab.) was unusually troublesome in New York State, including Long Island, extending its ravages to Maryland and the District of Columbia. The larva was also somewhat injurious to roots of radish and turnip.

The water-cress sowbug (*Mancasellus brachyurus* Harger) attracted very considerable attention because of its troublesome numbers in water cress grown for market in portions of Virginia, West Virginia, and Pennsylvania.

The usual amount of damage by cabbage "worms" was reported throughout the country. The cabbage looper (*Autographa brassicæ* Riley), which has not been generally injurious in its more northern range for a number of years, was somewhat abundant about the District of Columbia, particularly in Virginia, and was the cause of considerable damage to lettuce grown in greenhouses. The potherb butterfly (*Pontia napi* L.) was destructive to cabbage, turnip, and other crucifers in Montana and Alaska.

The harlequin cabbage bug (*Murgantia histrionica* Hahn), always a pest in the South, after an absence of about six years in the latitude of the District of Columbia, reappeared in noticeable numbers in near-by points in Maryland and Virginia.

Root maggots were the subject of less complaints than in the preceding four or five years. The seed-corn maggot (*Pegomya fusciceps* Zett.) was injurious to turnips in Alaska, to cabbage in South Carolina, and to sea kale introduced from England, where the species is also injurious. The imported cabbage maggot (*Pegomya brassicæ* Bouché) was the subject of considerable correspondence, but injury appears to be considerably lessened since 1905. Great injury, however, occurred in various portions of Alaska. Elsewhere the insect was noticeably abundant in northern Ohio and Minnesota. The imported onion maggot (*Pegomya cepetorum* Meade) was also less injurious than in the two or three previous years. The chief injury reported occurred in Indiana. The black onion fly (*Tritoxa flexa* Wied.) was injurious to onions in portions of Illinois and Minnesota, and was associated with the onion maggot. In portions of Illinois also there was another maggot on onions, *Lonchæa polita* Say), while in Ohio the barred onion maggot (*Chætopsis ænea* Wied.) was destructive.

The tarnished plant bug (*Lygus pratensis* L.) appeared on the whole to be only moderately numerous, but was injurious to onions grown for seed in Indiana, to potato, celery, ornamentals, and pear buds in Maine, and was concerned in injury to beets in California and cabbage in Alaska.

The onion thrips (*Thrips tabaci* Lind.) was injurious to onions in Texas, Massachusetts, and Indiana.

Injury by the melon aphis (*Aphis gossypii* Glov.) was somewhat general throughout its range. As usual, the greatest losses were to cantaloupe, although other melons, cucumbers, cotton, some ornamental plants, and others were badly affected. Many complaints were received from Texas, Florida, Kansas, Nebraska, Oklahoma, and California, somewhat general injury was incurred in Ohio and Illinois, and local injury was done in New York, New Jersey, Pennsylvania, and Tennessee. In portions of southern California cantaloupes were almost completely destroyed. In Oklahoma 60 per cent was lost in some localities.

The pickle worm (*Diaphania nitidalis* Cram.) appeared in injurious numbers about the District of Columbia for the first time in about ten years. It was also destructive in Arkansas.

The common stalk borer (*Papaipema nitela* Guen.) was less complained of than in the previous two or three years. Local injury, however, to a variety of vegetable crops and ornamentals was reported in New York, Pennsylvania, New Jersey, Connecticut, Michigan, Missouri, Illinois, Iowa, and Mississippi. Wheat was attacked about Lawrence, Kans., and Richmond, Ind.

The variegated cutworm (*Peridroma saucia* Hbn.) was destructive in California, doing mischief in greenhouses in Minnesota, and injuring vegetable crops and berries in Alaska and Mexico.

Injury by white grubs (*Lachnosterna* spp.) was very general in the northern United States from New England to Iowa and Wisconsin. The usual crops—potatoes, strawberry beds, beets, and other vegetables—were affected, and much complaint was made of damage to lawns. Injury to the roots of strawberry and to young orchard trees was reported in Oregon.

Wireworms were more injurious than in most years, complaints being most noticeable from California. The principal injury was caused to garden vegetables and sugar corn.

Insects Injurious to Deciduous Fruits.

The codling moth (*Carpocapsa pomonella* L.) has been for some years notably injurious in orchards in the Middle West, especially in the Ozark regions.

The apple maggot (*Rhagoletis pomonella* Walsh) is apparently becoming increasingly troublesome in some of the New England States, as Maine, New Hampshire, and Vermont, and has been the subject of frequent communications during the summer and fall. It was also quite abundant in the vicinity of Douglas, Mich., attacking principally the summer and early fall varieties of apples.

The green fruit-worm (*Xylina antennata* Walk.) was reported seriously destructive to apple orchards in southern Illinois, boring into the young fruit and destroying in some orchards a considerable percentage of the crop.

The apple leaf-hopper (*Empoasca mali* Le B.) has been more than usually abundant in the vicinity of Washington, D. C., and was the subject of complaint from the proprietor of a large nursery in Pennsylvania.

The spring canker-worm (*Paleacrita vernata* Peck) was much complained of in northern Virginia, central and western Pennsylvania, and eastern Ohio, where it appears to have been even more troublesome than in 1905.

The fall canker-worm (*Alsophila pometaria* Harr.) was received along with the preceding species from localities in western Pennsylvania, where, in the practical absence of remedial measures, it seems to be increasing in destructiveness.

The forest tent caterpillar (*Malacosoma disstria* Hbn.) and its near relative, *M. pluvialis* Dyar, were reported as very abundant and destructive in Washington State, attacking apple, plum, cherry, and rose.

A tussock moth (*Orgyia* sp.) was also very destructive in Washington State, causing serious defoliation of orchards.

The yellow-necked apple-tree caterpillar (*Datana ministra* Dru.) became quite abundant in apple orchards in northern Virginia, adjacent portions of West Virginia, western Pennsylvania, and Maine.

The red-humped apple-tree caterpillar (*Schizura concinna* S. & A.) along with the preceding, was very abundant in apple orchards in Maine, the two species causing considerable alarm from their depredations.

The trumpet leaf-miner (*Tischeria malifoliella* Clem.), which became very abundant in the vicinity of Washington, D. C., during the two previous years, was almost equally numerous in 1906, though it was not the subject of as much complaint as previously from near-by States and elsewhere.

The apple bud-borer (*Epinotia pyricolana* Murt.) was decidedly in evidence in young apple orchards in Virginia and Maryland in the environs of Washington, D. C., doing material injury by boring down the terminal shoots, thereby causing an undesirable branching.

A climbing cutworm, *Prodenia* sp., was troublesome in apple orchards in northern Virginia and adjacent territory in West Virginia, young trees being practically stripped of foliage and the branches of older ones more or less denuded. Injury was most severe in orchards which had been in sod for the past two or three years.

The pear psylla (*Psylla pyri* L.) was reported seriously injurious to Kieffer pears in one locality in Virginia. This species was abundant in Virginia and Maryland in 1894, but has not since attracted much attention.

The plum curculio (*Conotrachelus nenuphar* Hbst.) was the subject of a very large amount of inquiry from various portions of the territory over which it is distributed.

The peach borer (*Sanninoidea exitiosa* Say) maintains its place with the plum curculio as one of the two principal enemies of the peach. Frequent inquiries come, especially from the South and Southwest, concerning this insect, particularly from persons who have recently gone into peach culture.

Evippe prunifoliella Chamb. became destructive to peach at Saugatuck, Conn., folding the leaves along the edge and also at the tip.

A new sawfly enemy of the peach (*Lyda* sp.) is reported to have been quite injurious locally in Connecticut. The slugs feed on the foliage, stripping the trees more or less completely.

A plum aphis (*Aphis setariæ* Thos.) became unusually abundant in the spring in parts of the South. Numerous complaints were received from southern Louisiana, in the vicinity of New Orleans and Lake Charles; also from Alabama, Georgia, and Kentucky. The insect occurred mostly on the plum, but in one instance the peach was attacked.

An unusually serious attack on the peach by the scurfy scale (*Chionaspis furfura* Fitch) was noted in Georgia in a block of three or four-year-old trees, the insect rivaling in destructiveness the San Jose scale. Judging from the injury caused by this insect there are doubtless two or more broods in that section each year. The species is reported uncommonly abundant in certain orchards in the Hudson River Valley in New York State.

The oyster-shell scale (*Lepidosaphes ulmi* L.) continued seriously injurious in Maryland and Pennsylvania.

The terrapin scale (*Eulecanium nigrofasciatum* Perg.) has become very troublesome in a few peach orchards in western Maryland, and its occurrence in unusual numbers was noted in New Jersey.

The San Jose scale (*Aspidiotus perniciosus* Comst.) continued to attract much attention, especially in regions recently invaded by it. It was observed in new localities in apple-growing regions of the Ozark Mountains, and the orchardist of that section will undoubtedly have to contend with it in the near future.

Another scale insect became prominent as a pest of deciduous fruits, namely, Howard's scale (*Aspidiotus howardi* Ckll.). This insect was reported abundant and destructive in orchards on the west slope in Colorado, infesting pear, prune, plum, almond, and apple, as well as certain shade trees.

The grape root-worm (*Fidia viticida* Walsh) became a very serious pest in the Erie grape belt in Pennsylvania, and was somewhat more destructive in the Chautauqua grape belt in western New York than for the preceding year or so.

The grape berry moth (*Polychrosis viteana* Clem.) was serioully destructive in the same territory as that mentioned above for the grape root-worm, as well as in northern Ohio.

The grapevine leaf-hopper (*Typhlocyba comes* Say) continued a serious grape pest in the Erie grape belt.

The grape curculio (*Craponius inæqualis* Say) was quite as destructive in West Virginia as during 1905.

The rose-chafer (*Macrodactylus subspinosus* Fab.) is apparently again on the increase, as indicated by the numerous complaints made. Specimens were received from many localities in the East-Central States—for example, Maryland, Virginia, New Jersey, Pennsylvania, Ohio, and New York. Serious injury or total destruction of grapes, cherries, apples, and peaches was noted by correspondents.

Amphicerus punctipennis Lec. was received in grape canes from Miami, Fla. The species is also recorded from Tiger Mills, Tex., and Riverside, Cal.

Insects Injurious to Citrus and Other Tropical Fruits.

There is little change from year to year in the amount of damage from scale and other common enemies of citrus fruits. The black scale (*Saissetia oleæ* Bern.) and the red scale (*Aonidiella aurantii* Mask.) continue to be the prominent pests in southern California, and the white fly (*Aleyrodes citri* R. & H.) and the purple scale (*Lepidosaphes beckii* Newm.) in Florida. Work under a special appropriation for the white fly is under way in Florida, and this insect will be studied in the coming year throughout its range on the Gulf coast.

Very good reports are still coming of the South African parasite of the black scale in southern California, but the work of this parasite has not by any means eliminated the black scale as an important pest.

Insects Injurious to the Nut Industry.

The pecan crop of Texas was reported generally short. Only two insects, however, were especially prominent as pests. The pecan huskworm (*Enarmonia caryana* Fitch) was injurious in portions of Georgia and South Carolina, and, on the authority of Mr. F. C. Pratt, did injury also to walnuts at Boerne, Tex. Shortage in the pecan crop in other portions of the South was attributed to this pest. The pecan weevil (*Balaninus caryæ* Horn) was somewhat unusually abundant.

The chestnut crop in some sections also showed a shortage, but the chestnut weevils (*Balaninus rectus* Say and *B. proboscideus* Fab.) were not complained of so frequently as in previous years. Loss in one locality in Pennsylvania, however, was estimated

at 40 per cent, a gradual growth beginning with 5 per cent loss experienced five years previously. A red spider, *Tetranychus bicolor* Bks., was the occasion of complaint among chestnut growers in portions of Pennsylvania and Connecticut, and this pest, together with "blight," was doubtless responsible for other losses of which there was complaint.

INSECTS INJURIOUS TO SHADE AND ORNAMENTAL TREES.

The brown-tail moth (*Euproctis chrysorrhœa* L.) has extended its western range to the vicinity of Amherst, Mass., and seems to be proceeding in a westerly direction more slowly than it has been spreading to the northeast. It is now found more than halfway up the Maine coast and has been reported from Eastport. It occurs in the two lower tiers of counties in New Hampshire in considerable numbers and has been collected in the White Mountain region.

The gipsy moth (*Ocneria* [*Porthetria*] *dispar* L.) has been found during the year near Stonington, Conn., and several colonies have been located in Rhode Island. It occurs very generally in the southern tier of counties of New Hampshire, and recent scouting in Maine has shown the establishment of the species at several points in the southwestern portion of that State. Its western limit still seems to be in that part of Massachusetts which lies in the longitude of Worcester.

As a result of the widespread interest which the occurrence of these two species occasioned in New England and neighboring States, certain other caterpillars were the subject of considerable complaint. Prominent among these was the black walnut caterpillar (*Datana integerrima* G. & R.), which attracted attention in New York. It was also injurious to walnut at Bristol, Tenn., and at Rockford, Ill., and to pecans at Staunton, Va. The hickory tussock moth (*Halisidota caryæ* Harr.) was destructive to elm in Massachusetts and was the subject of complaint also in New York.

The sugar maple borer (*Plagionotus speciosus* Say) continued to be a serious pest in New York, and some complaints were made of its injuries in Ohio.

The white-marked tussock moth (*Hemerocampa leucostigma* S. & A.) was abundant during the year 1906, but not nearly so troublesome as in many other years. It was particularly numerous in the States of New York, Pennsylvania, Maine, Connecticut, Virginia, and Iowa, attracting most attention as a pest in public parks and in the streets of cities and large towns. It was similarly abundant in the District of Columbia and in Nova Scotia.

The fall webworm (*Hyphantria cunea* Dru.) was, on the whole, remarkably scarce, small colonies only occurring. Among the localities infested were the District of Columbia, Lynn, Mass., New Wilmington, Pa., and New York City.

The imported willow curculio (*Cryptorhynchus lapathi* L.) was destructive to willow and poplar, especially in nurseries in various parts of New York State.

The cottony maple scale (*Pulvinaria innumerabilis* Rathv.), which was so abundant in 1905 practically disappeared as a pest in New Jersey.

The false maple scale (*Phenacoccus acericola* King) was abundant in several cities in New York, and especially in the vicinity of New York City.

The catalpa sphinx (*Ceratomia catalpæ* Bdv.) was very destructive to the foliage of catalpa, reports of defoliation having been received from New Jersey, where the pest is generally distributed, and from portions of Ohio and Alabama. In Maryland and Virginia the species was abundant, but not so troublesome.

The elm-tree borer (*Saperda tridentata* Ol.) was the cause of considerable complaint, injuries being especially noticeable in the vicinity of St. Louis, Mo., and Evanston, Ill.

A new oriental moth (*Cnidocampa flavescens* Walk.), whose original home is in Asia, was observed on a variety of shade, orchard, and wild trees in the vicinity of Dorchester, Mass. As its habits as thus far studied in this country show that it is capable of subsisting on all sorts of vegetation, such as bush fruits and rose, there is danger of the permanent introduction of this species into America as a pest.

The maple leaf stem-borer (*Priophorus acericaulis* McG.) was injurious to maple shade trees in the vicinity of New Haven, Conn., and probably elsewhere. The species has not hitherto been noted as a pest and was only recently described because new to science.

The currant leaf-hopper (*Empoasca mali* Le B.) was very abundant on shade trees in the District of Columbia, doing particular damage to the hop tree. It also attacked violets grown in a greenhouse in Virginia.

The greenhouse red spider (*Tetranychus bimaculatus* Harv.) was extremely troublesome, both in greenhouses and fields and on shade trees, its injuries extending from New York and the District of Columbia to Illinois. General complaint of mite injury to shade trees was also made in New Jersey and is probably attributable to this species.

Insects Injurious to Forests and Forest Products.

The Black Hills beetle (*Dendroctonus ponderosæ* Hopk.) continued its depredations to such an extent in the Black Hills Forest Reserve of South Dakota that as yet it has not been practicable, owing to the lack of sufficient funds and other facilities, to accomplish anything of importance toward carrying out the recommendations for its control. The radical measures adopted in the vicinity of Colorado Springs and the Pikes Peak Forest Reserve, Colo., under the same recommendations, have, on the other hand, apparently brought the pest under complete control in that locality.

The mountain pine beetle (*Dendroctonus monticola* Hopk.) was the direct cause of the death of a considerable amount of lodgepole pine in the higher elevations of the Yosemite National Park and in other localities in the Sierra Nevada Mountains in California. It was also reported in destructive numbers in Oregon, Idaho, and Utah.

The destructive pine beetle (*Dendroctonus frontalis* Zimm.), while continuing to be a menace to the pine forests of the South, was not more than usually abundant in the South Atlantic and Gulf States. For the first time since the disastrous outbreak of 1891–92 it was found as far north as Virginia. Investigations in the southeastern part of that State indicated that it had been present in limited abundance for several years, apparently without much, if any, increase in numbers.

The spruce beetle (*Dendroctonus piceaperda* Hopk.) was not reported in destructive abundance in any section of the country. It was found in small numbers attacking spruce in New Hampshire, northern Michigan, and the Black Hills of South Dakota, and the western form was reported as causing some injury to the Engelmann spruce in Colorado and Wyoming.

The Douglas spruce beetle (*Dendroctonus pseudotsugæ* Hopk.) was reported as destructive to the red fir or Douglas spruce in many widely separated localities in the Rocky Mountain region.

The larch beetle (*Dendroctonus simplex* Lec.) was found attacking larch or tamarack in small numbers in the upper peninsula of Michigan. Although not at present a serious enemy of the tree, it may prove to be of importance in connection with the depredations of the larch sawfly.

The western pine beetle (*Dendroctonus brevicomis* Lec.) was found attacking pine in the Yosemite Valley and other localities in California, and reported from Oregon. In Idaho the recommendations of this Bureau for its control have been adopted by certain of the larger lumbering concerns.

The two-lined chestnut borer (*Agrilus bilineatus* Web.) was found in Massachusetts attacking and hastening the death of oak trees which had been defoliated by the gipsy and brown tail moths.

The white-pine weevil (*Pissodes strobi* Peck) occurred in its usual abundance in the Eastern States. It was found also in Michigan, in young white pine reproduction, and appears to be increasing in abundance there.

Cerambycid borers (species at present unknown) were reported as injuring telephone poles in Maryland and West Virginia. They attack the poles near the surface of the ground, and so weaken them as to cause them to break.

Cedar heartwood borers (*Trachykele blondeli* Mars. and *T. opulenta* Fall) were identified as the cause of serious injury to the heartwood of various western cedars. The injury has been long known, but the insect causing it has been unknown until this year.

Powder-post beetles (*Lyctus* spp.) continued to be a source of frequent complaint from dealers and manufacturers of hardwood products. *L. unipunctatus* Hbst. was the most common species infesting oak and hickory spokes, handles, etc.; *L. planicollis* Lec. was found attacking ash lumber in the South, and *L. parallelopipedum* Mels. injuring persimmon shuttle blocks in Georgia. The red-shouldered powder-post borer (*Sinoxylon basilare* Say) caused serious injury to last and shuttle blocks of persimmon wood in Georgia and Ohio.

The larch sawfly (*Holcocneme* [*Nematus*] *erichsonii* Hartig) was unusually abundant and destructive in the upper peninsula of Michigan. Complaint of injury was received in 1905, but it appears that the area over which the larch was defoliated was considerably more extensive in 1906. Defoliation of the larger trees over a large part of the upper peninsula was complete, but as yet none appear to be dying from this cause alone.

The fir tussock moth (*Notolophus oslari* Barnes) was the cause of extensive defoliation of the tops of white fir (*Abies concolor*) in Mariposa County, Cal., and was also found in considerable abundance attacking the same tree in Colorado. It is supposed that the repetition of this injury is responsible for the dead tops common on fir throughout a large portion of the Rocky Mountain and Sierra Nevada regions.

Dalcerides ingenita Hy. Edw., a species of slug caterpillar, was reported seriously defoliating "live oak scrub" near Payson, Ariz. The habits of this insect were not known previously.

Insects Injurious to Stored Products.

The Mediterranean flour moth (*Ephestia kuehniella* Zell.), that scourge of the flour mill, greatly increased its range, having been reported from four times as many localities as in any previous year. Its injuries were particularly noticeable in new localities in California, Oregon, Maryland, Ohio, Michigan, Pennsylvania, New York, Wisconsin, and Illinois. It was doubtfully reported from South Dakota, Iowa, and West Virginia.

The European grain moth (*Tinea granella* L.) has apparently become established in this country, as considerable correspondence was received in regard to its occurrence in seed storehouses and mills in portions of Connecticut, Michigan, New York, and Canada. It bred in corn seed and dry stalks, and in ground buckwheat.

The spider beetle (*Ptinus fur* L.) caused serious damage to a case of uniforms of heavy felted cloth in an Ohio locality, and was also found in some numbers in flour in a flour mill at Ontario, Canada.

Hadrobregmus carinatus Say, another ptinid beetle new as a household pest, made its appearance at Toledo, Ohio, and Hamburg, Mich., working somewhat after the manner of the powder-post beetles (*Lyctus* spp.), in white ash and basswood flooring, the former wood being comparatively new and the latter very old.

The cigarette beetle (*Lasioderma serricorne* Fab.) appears to be increasingly destructive year by year, many complaints having been received during 1906. It affected tobacco of all kinds, and its injuries were well distributed throughout the eastern United States and extended westward into Arizona. It also injured herbarium specimens at St. Louis, Mo., and was troublesome in upholstered furniture in the District of Columbia, West Virginia, and New Jersey.

Insects and Ticks as Animal Parasites and as Conveyors of Disease.

The insect and tick parasites of domestic animals and man vary but slightly as regards abundance from year to year. The following observations, however, on some of these pests are of interest:

The cattle tick (*Boophilus annulatus* Say) does not vary decidedly in numbers from year to year. In 1906 the usual loss from Texas fever, estimated at $40,000,000 to $100,000,000, may be attributed to it.

The lone star tick (*Amblyomma americanum* L.) ranks next, though its importance is immeasurably less because it does not transmit disease. In 1906 it was very numerous, especially in regions where sheep and goats are kept.

The tropical horse tick (*Dermacentor nitens* Aud.) was discovered in this country for the first time by an agent of the Bureau of Entomology, and its occurrence over a considerable area in southern Texas was determined.

The gulf coast tick (*Amblyomma maculatum* Koch), which has previously attracted no attention, was found very commonly along the coasts of Texas and Louisiana infesting cattle, horses, dogs, and man.

The tropical tick (*Amblyomma cajennense* Koch) was observed in Texas as far north as Beeville.

The dog Rhipicephalus (*Rhipicephalus* sp.) was found commonly over a large area in southern Texas. Its close relationship to disease-transmitting species gives it considerable interest.

A horse fly (*Tabanus opacus* Coq.) caused much annoyance to horses and cattle in Wyoming.

The screw worm (*Chrysomyia macellaria* Fab.), always a source of trouble in Texas, was annoying to stock. The same is true of the horse bot (*Gastrophilus equi* Fab.), which was observed in the same State everywhere as far west as Ozona.

Miscellaneous or Unclassified Insect Pests.

INSECTS INJURIOUS IN GREENHOUSES AND IN FLOWER GARDENS.

The violet gall midge (*Contarinia* [*Diplosis*] *violicola* Coq.) has become a very serious pest in the extensive violet-growing industry in the Hudson River valley region of New York. The rose leaf-beetle (*Nodonota puncticollis* Say) was injurious to roses in the vicinity of the District of Columbia. The rose leaf-hopper (*Typhlocyba rosæ* Harr.) was quite troublesome during the year and caused considerable complaint because of its work on rose bushes in and about the District of Columbia, as also in New York State. The red-banded leaf-hopper (*Diedrocephala coccinea* Forst.) was injurious to ornamental plants in Central New York and in the District of Columbia, China aster, roses, and hibiscus being particularly injured. Lilac bushes at Stony Brook, N. Y., were reported badly damaged by a giant scarabæid beetle, *Xyloryctes satyrus* Fab. The greenhouse leaf-tyer (*Phlyctænia ferrugalis* Hbn.) was a pest in greenhouses in Michigan.

STRAWBERRY INSECTS.

The strawberry crown girdler (*Otiorhynchus ovatus* L.) was very destructive in King County, Wash., to strawberry plants. An estimated loss of about $55,000 was made for that county. It was observed on ornamental plants about Chicago, Ill. The strawberry leaf-roller (*Ancylis comptana* Fröhl.) was abundant in Maryland and Virginia near the District of Columbia, and was complained of in Illinois and Missouri. The strawberry sawfly (*Harpiphorus maculatus* Nort.) was injurious in Massachusetts.

MISCELLANEOUS.

The Rocky Mountain locust (*Melanoplus spretus* Thos.) was very destructive in portions of South Dakota. One correspondent reported the total destruction of nursery plantings, the damage aggregating $800.

A red spider (*Tetranychus* sp.) was reported as causing much damage to hops in portions of the State of Washington, one grower reporting an almost total loss.

The calloused bill-bug (*Sphenophorus callosus* Ol.) was destructive to chufa, and was concerned in injury to timothy in Virginia near the District of Columbia.

Of pests related to insects, a sowbug (*Porcellio lævis* Latr.) was injurious to mushrooms grown commercially in the District of Columbia and Kansas. Many complaints were also received of slugs and their injuries to plants of various kinds. Angleworms also were present in troublesome numbers in gardens, on lawns, on golf links, and in some cases in large fields.

AREAS SURVEYED AND MAPPED BY THE BUREAU OF SOILS.

By A. G. Rice, *Chief Clerk, Bureau of Soils.*

The following statement shows the location and extent of soil surveys made up to December 31, 1906. The Bureau prepares and issues a lithograph map, drawn on a scale of 1 mile to the inch, for each area surveyed, indicating in colors the distribution of the various soil types. The accompanying sketch map (fig. 20) gives the location of these areas.

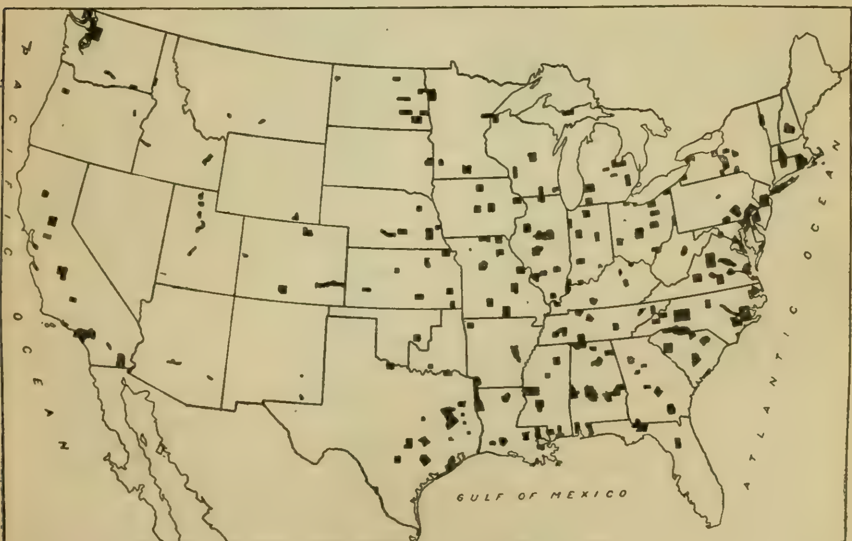


Fig. 20.—Areas covered by the Soil Survey.

The statement gives a list of the areas surveyed with the number of square miles in each, and the total area surveyed in each State and Territory. The total for the United States is 128,198 square miles, or 82,046,720 acres.

Areas of soil surveys in the United States to December 31, 1906.

	Square miles.	
Alabama:		
Blount County	625	
Dallas County	992	
Fort Payne area	509	
Huntsville area	506	
Lauderdale County	708	
Lee County	629	
Macon County	621	
Mobile area	461	
Montgomery County	780	
Perry County	762	
Sumter County	893	
		7,486
Arizona:		
Buckeye sheet	43	
Phoenix sheet	243	
Solomonsville area	108	
Tempe sheet	163	
Yuma area	340	
		897
Arkansas:		
Fayetteville area	569	
Miller County	626	
Prairie County	656	
Stuttgart area	251	
		2,102
California:		
Bakersfield area	195	
Fresno area	628	
Hanford area	216	
Imperial area	1,084	
Indio area	234	
Los Angeles area	570	
Sacramento area	924	
Salinas sheet	189	
San Bernardino area	755	
San Gabriel area	259	
San Jose area	313	
Santa Ana area	275	
Solidad sheet	155	
Stockton area	521	
Ventura sheet	240	
Willow area	375	
		6,933
Colorado:		
Arkansas Valley area	945	
Grand Junction area	168	
Greeley area	687	
San Luis area	628	
		2,428
Connecticut:		
Connecticut Valley		505
Delaware:		
Dover area		314
Florida:		
Escambia County	662	
Gadsden County	548	
Gainesville area	485	
Leon County	675	
		2,370
Georgia:		
Bainbridge area	364	
Cobb County	346	
Covington area	225	
Dodge County	489	
Fort Valley area	186	
Spalding County	205	
Waycross area	609	
		2,424
Idaho:		
Boise sheet	155	
Blackfoot area	428	
Caldwell sheet	244	
Lewiston area	308	
		1,135
Illinois:		
Clay County	460	
Clinton County	491	
Johnson County	339	
Knox County	717	
McLean County	1,159	
O'Fallon area	68	
Sangamon County	866	
St. Clair County	650	
Tazewell County	645	
Winnebago County	526	
		5,921
Indiana:		
Boonville area	264	
Greene County	535	
Madison County	435	
Marshall County	445	
Newton County	393	
Posey County	387	
Scott County	197	
Tippecanoe County	499	
		3,155
Indian Territory:		
Tishomingo area		443
Iowa:		
Cerro Gordo County	567	
Dubuque area	440	
Story County	576	
Tama County	720	
		2,303
Kansas:		
Allen County	504	
Brown County	573	
Garden City area	335	
Parsons area	398	
Riley County	634	
Russell area	270	
Wichita area	465	
		3,179
Kentucky:		
McCracken County	242	
Madison County	437	
Mason County	225	
Scott County	280	
Union County	361	
Warren County	533	
		2,078
Louisiana:		
Acadia Parish	636	
Caddo Parish	898	
De Soto Parish	825	
East Baton Rouge Parish	451	
Lake Charles area	202	
New Orleans area	410	
Ouachita Parish	605	
Tangipahoa Parish	788	
		4,815
Maryland:		
Calvert County	217	
Cecil County	376	
Harford County	418	
Kent County	293	
Prince George County	480	
St. Mary County	363	
Worcester County	463	
		2,610
Massachusetts:		
Connecticut Valley		809
Michigan:		
Allegan County	828	
Alma area	282	
Cass County	500	
Munising area	407	
Oxford area	210	
Owosso area	270	
Pontiac area	307	
Saginaw area	984	
		3,788
Minnesota:		
Blue Earth County	749	
Carlton sheet	413	
Crookston area	779	
Marshall area	233	
		2,174
Mississippi:		
Biloxi area	615	
Crystalsprings area	231	
Jackson area	737	
Mayersville sheet	193	
McNeill area	198	
Montgomery County	405	
Pontotoc County	498	
Smedes area	463	
Yazoo sheet	463	
		3,803

Areas of soil surveys in the United States to December 31, 1906—Continued.

	Square miles.	
Missouri:		
Crawford County	747	
Howell County	919	
O'Fallon area	552	
Putnam County	523	
Saline County	748	
Scotland County	440	
Shelby County	511	
Webster County	605	
		5,045
Montana:		
Billings area	107	
Gallatin Valley area	325	
		432
Nebraska:		
Grand Island area	446	
Kearney area	792	
Lancaster County	857	
Sarpy County	227	
Stanton area	323	
		2,645
New Hampshire:		
Merrimack County		923
New Jersey:		
Salem area	493	
Trenton area	810	
		1,303
New Mexico:		
Carlsbad sheet	80	
Roswell sheet	49	
		129
New York:		
Auburn area	461	
Bigflats area	223	
Binghamton area	229	
Long Island area	845	
Lyons area	515	
Madison County	649	
Niagara County	547	
Syracuse area	416	
Tompkins County	493	
Vergennes area	160	
Westfield area	260	
		4,798
North Carolina:		
Alamance County	365	
Asheville area	497	
Cary sheet	63	
Chowan County	178	
Clayton sheet	214	
Craven area	897	
Duplin County	824	
Hickory area	988	
Kinston sheet	257	
Mount Mitchell sheet	497	
Newbern sheet	46	
New Hanover County	192	
Parmele area	236	
Perquimans and Pasquotank counties	461	
Princeton sheet	248	
Saluda area	190	
Statesville area	784	
Transylvania County	372	
		7,309
North Dakota:		
Cando area	283	
Carrington area	720	
Fargo area	406	
Grand Forks area	31[illegible]	
Jamestown area	496	
Ransom County	856	
Williston area	585	
		3,660
Ohio:		
Ashtabula area	340	
Cleveland area	509	
Columbus area	472	
Coshocton area	551	
Meigs County	443	
Montgomery County	480	
Toledo area	403	
Westerville area	476	
Wooster area	469	
		4,143
Oklahoma:		
Oklahoma County		720
Oregon:		
Baker City area	158	
Salem area	284	
		442
Pennsylvania:		
Adams County	534	
Chester County	760	
Lancaster area	269	
Lebanon area	669	
Lockhaven area	278	
Montgomery County	496	
		3,006
Porto Rico:		
Arecibo to Ponce		330
Rhode Island.		
State		1,085
South Carolina:		
Abbeville area	1,006	
Campobello area	515	
Charleston area	352	
Cherokee County	361	
Darlington area	599	
Lancaster County	486	
Orangeburg area	709	
York County	669	
		4,697
South Dakota:		
Brookings area		484
Tennessee:		
Clarksville area	547	
Davidson County	501	
Grainger County	307	
Greeneville area	664	
Henderson County	499	
Lawrence County	618	
Madison County	561	
Pikeville area	440	
		4,137
Texas:		
Anderson County	1,069	
Austin area	705	
Brazoria area	845	
Henderson area	581	
Houston County	1,192	
Jacksonville area	100	
Lavaca County	995	
Laredo area	155	
Lee County	666	
Lufkin area	99	
Nacogdoches area	97	
Paris area	548	
San Antonio area	484	
San Marcos area	515	
Vernon area	277	
Waco area	495	
Willis area	215	
Woodville area	100	
		9,138
Utah:		
Bear River Valley	334	
Provo area	373	
Salt Lake sheet	249	
Sevier Valley	235	
Weber County	310	
		1,501
Vermont:		
Vergennes area		227
Virginia:		
Albemarle area	1,410	
Appomattox County	340	
Bedford area	632	
Chesterfield County	478	
Hanover County	475	
Leesburg area	419	
Louisa County	505	
Norfolk area	303	
Prince Edward County	430	
Yorktown area	598	
		5,590

Areas of soil surveys in the United States to December 31, 1906—Continued.

	Square miles.	
Washington:		
Island County	[illegible]	
Everett area	[illegible]	
Sunnyside sheet	[illegible]	
Walla Walla area	[illegible]	
Yakima sheet	[illegible]	
		[illegible]
West Virginia:		
Upshur County	[illegible]	
Wheeling area	[illegible]	
		[illegible]
Wisconsin:		
Janesville area	451	
Portage County	797	
Racine County	326	
Superior area	482	
Viroqua area	504	
		2,560
Wyoming:		
Laramie area		309
Total		[illegible]

PROGRESS IN FOOD AND DRUG INSPECTION AND CORRELATED INVESTIGATIONS.

By H. W. Wiley, *Chief of Bureau of Chemistry.*

The passage of the food and drugs act, June 30, 1906, after continuous efforts to obtain such legislation for more than a quarter of a century, undoubtedly is the greatest advancement in the field of investigations covered by the work of the Bureau of Chemistry during 1906 and marks what may almost be called a reformation in many industries connected with the production of foods and medical and pharmaceutical preparations. Much work had been done in the Bureau in the direction of revealing the conditions that necessitated this law, by the publication of analyses of goods purchased in the open market, the disclosure of discrepancies between the label and the product, the compilation of State food and drug laws showing need of uniformity and the difficulties and injustices suffered by dealer, consumer, and the honest manufacturer alike when interstate commerce was conducted under such varying conditions. Cooperation with the Post-Office Department in excluding fraudulent medicinal preparations from the mails had revealed an evident need of regulation of such preparations which were often harmful as well as fraudulent.

Although the law did not become operative until January 1, 1907, its effect was noticeable soon after the passage of the act. The great majority of manufacturers have shown that they are anxious to comply with the law and have hastened to make the necessary changes in their products and labels. It is apparent that as far as most of the reputable manufacturers and dealers are concerned the law will be largely self-operative, and as a rule the decisions of the Department are accepted without protest. Careful inspection will, of course, be necessary, however, in order to protect these interests from unfair competition with such dealers or manufacturers as might, by misbranding and otherwise misrepresenting their goods, undersell the honest merchant. To this end a number of laboratories, serving as centers of inspection in which this work will be largely conducted, are being established in addition to the six laboratories at Chicago, Philadelphia, New York, Boston, New Orleans, and San Francisco, at which ports imported foods have been inspected during the past two years. The improvement in the labeling of imported goods, the statements made as to colors and preservatives, etc., show continuing improvement under this inspection.

The improvement to be expected from the regulation of the sale of drugs and pharmaceutical preparations is already evidenced by the steps taken to produce pure products and to eliminate misrepresentations and false claims as set forth in the labels. Other progressive activities set in operation by this law include the attention being given to the establishment of much needed standards for the various products subject to the act and the work of the council on pharmacy and chemistry, in which this Bureau has cooperated, which has called to account many remedies which have in the past masqueraded under false colors.

In the same way a vast amount of research work has been inaugurated and some phases of it completed looking to the determination of the effect of preservatives and coloring matters on health and digestion; the effect of cold storage, especially on fowls, birds, and eggs; and the bacteriological-chemical studies of milk, ice cream, etc., for the better protection of public health and the establishment of requirements and regulations governing such products. During the past year the study of the effect of preservatives made at the hygienic table of the Bureau has been devoted to the special investigation of certain points which the previous work indicated as being of special significance or needing further elaboration, the same preservatives being employed as in the more general studies, i. e., boric acid, sulphurous acid, and sulphites. The physiological effects of formaldehyde, benzoic acid, and copper sulphates have been

also investigated along the lines followed in the bulletins on borax and salicylic acid (No. 84, Parts I and II) already issued. The results with these additional preservatives are now almost ready for publication.

In nearly all of the laboratories of the Bureau investigations are in progress which bear upon the subject of food and drug control, the establishment of standards, the character of goods on the market, and methods for the improvement of processes and products. Among these may be mentioned the following:

An investigation, in the miscellaneous laboratory, of concentrated feeding stuffs as sold on the American market, including the analysis of approximately 400 cattle foods to determine their composition and whether or not they are adulterated. Also the study of the composition of mineral waters in the United States has been continued, providing valuable data in connection with the enforcement of the food and drugs act as affecting this class of products. Illustrative of the efforts made to improve processes may be mentioned the investigation of materials and methods used in canning foods.

The most striking investigation looking to the improvement of the quality of raw materials is perhaps the experiment made with wheat grown in semiarid regions and under irrigation, or in localities having a heavy rainfall. The work at its present stage appears to indicate that, of all the factors influencing the composition of wheat, water plays a predominant part, the wheats grown under semiarid conditions being much higher in nitrogen. Both pot experiments and field work have pointed toward the same conclusion, i. e., an excess of water is accompanied by a decrease in nitrogen content, which opens up the possibility of determining the amount of irrigation which should be practiced to produce a crop of wheat containing the maximum nitrogenous content and making the largest yield.

In thus outlining the progress made along a few of the lines of activity opened up or made more vital by the demands of the new law, it is important to emphasize the fact that their complete and satisfactory accomplishment can only be effected by conservative methods; but the effect of the institution of such work and the enactment of such a law has been far-reaching in its practical and beneficial effects even in its initial stages—beneficial alike to consumer, producer, and our commercial status as a Nation.

REVIEW OF ROAD LAWS ENACTED IN 1906.

By M. O. Eldridge, *Chief of Records, Office of Public Roads.*

The legislatures of only about one-fourth of the States were in session during the year 1906. Notwithstanding this fact, some very important road laws were enacted.

The legislatures of twelve States adopted 81 bills relating to road improvement and administration. A brief synopsis of the most important of these measures is presented herewith.

Iowa.—An act approved February 14, 1906, authorizes the use of the split-log drag in maintaining earth roads. Dragging must be done under the direction of the road superintendents, who may allow not to exceed 50 cents per mile for each dragging or $5 per mile for dragging the road for one year.

Another act, approved March 10, 1906, provides that all persons who use wagons on public roads with tires not less than 3 inches in width for hauling loads exceeding 800 pounds in weight shall receive a rebate of one-fourth of their highway tax, provided such rebate shall not exceed $5 per annum.

Kentucky.—Any county in this State owning turnpike roads is authorized by an act approved March 21, 1906, to collect tolls on such roads, provided the same is agreed to by a majority of the legal voters of the county. The fiscal courts are required to appropriate to each road on which tolls are collected all the money so collected for the purpose of keeping the road in repair. Where the capital stock of turnpike roads is owned by the commonwealth of Kentucky and any county or counties, the share owned by the State may be transferred to the county, according to an act approved March 17, 1906, provided the county agrees to maintain the road and to collect no tolls thereon.

If agreed to by a two-thirds vote of the people, a special tax of not to exceed 25 cents on each $100 worth of assessed property may be levied for the construction and repair of roads in the various counties of this State, according to an act approved March 21, 1906. In working out this tax the road overseer may allow $1 for each day's work and $2.50 per day for each two-horse team and wagon.

New Jersey.—The salary of the State commissioner of public roads is increased by an act approved April 2, 1906, from $1,500 to $5,000 per annum; the allowance for

his expenses is also increased from $1,500 to $4,000 per annum, and the salary of the State supervisor, who shall be a competent civil engineer, is fixed at $2,500 per annum.

According to a law approved June 26, 1906, roads constructed by the boards of chosen freeholders of the counties, with or without State aid, may be maintained by the township, town, or borough in which they are located, under the direction of the State commissioner of public roads.

Another law provides that the purchase or condemnation of toll roads which have been permanently improved with stone or gravel may be paid for, one-third by the State and two-thirds by the county. Ten per cent of the two-thirds may be paid by the township or municipality in which the road is located. The county may borrow money temporarily to pay its share for such roads.

New York.—The issuance of $50,000,000 in bonds, provided for in section 12, article 7, of the constitution, was legalized May 16, 1906. Funds realized from the sale of those bonds are to be expended under the Higbie-Armstrong State aid law in the permanent improvement of the public highways, the State paying one-half of the cost, the counties 35 per cent, and the townships or property owners 15 per cent. The bonds are to be issued in two classes, A and B. Class A bonds are to run for a period of 50 years and bear interest at 3½ per cent and be redeemable from a fund maintained by the State. An annual tax of 0.0055 mill upon each $1 worth of property for every million dollars worth of bonds outstanding is provided to pay the interest and to create a sinking fund with which to redeem Class A bonds. Class B bonds also bear interest at the rate of 3½ per cent and are to be paid in 50 equal annual installments by the county and townships wherein the proceeds have been applied to the improvement of highways. The counties and towns which do not desire to avail themselves of funds derived from the sale of these bonds may pay their share of the cost of State aid roads in cash. Interest and principal on Class B bonds are paid by a tax which is levied on a basis of 70 per cent upon the county and 30 per cent upon the township. The sum of $5,000,000 was appropriated for 1906 out of moneys realized from the sale of these bonds for the purpose of improving the highways according to the State aid laws.

The town law relating to highway commissioners is amended according to an act approved May 10, 1906, so as to provide that towns which have adopted the money system and have more than one highway commissioner, may reduce the number of commissioners to one, if agreed to by a majority of the voters at a special meeting.

The highway law was amended May 10, 1906, so as to provide that supervisors and the highway commissioner or commissioners of towns receiving State aid shall annually report to the State engineer, on forms provided for the purpose, all expenditures for road and bridge purposes, sources of revenue, machinery and tools on hand. The highway commissioners and supervisors are required to use, for keeping accounts of moneys collected and expended, such forms as may be prescribed by the State engineer.

Ohio.—The county commissioners are authorized by law, approved March 3, 1906, to issue bonds for the purpose of reimbursing boards of road commissioners appointed by the county commissioners for indebtedness in connection with road improvements carried on by virtue of any legislative act. Such bonds may be issued for such amounts and such length of time and for such rate of interest as the county commissioners may determine. The commissioners are authorized to levy an annual tax on all property within the precinct or road district out of which to pay interest and principal.

Revised Statutes of Ohio in relation to the National Road were amended March 29, 1906, so as to provide that the county commissioners in any county through which the National Road (Old Cumberland Road) passes are authorized to require township trustees to maintain portions of the road which pass through their township.

Rhode Island.—An act passed February 20, 1906, provides for the issuance of scrip or certificates of indebtedness in the name of the State to the amount of $600,000. They are to mature in at least thirty years and bear interest at the rate of not to exceed 3 per cent. Of these bonds, $200,000 are to be issued and sold before January 1, 1907, and the balance on or before January 1, 1908, in such installments as the State treasurer may determine. The amount necessary to pay the annual interest and provide for a sinking fund to pay off the bonds is to be included in the annual appropriation bill for State expenses. The funds derived from the sale of these bonds are to be expended under the direction of the State board of public roads in the construction of a system of State roads, the State paying the whole cost, as provided by law.

Virginia.—On March 6, 1906, a law was approved which provided for the establishment of a State highway commission, consisting of a State highway commissioner, appointed by the governor, who shall be a civil engineer and a citizen of the State,

and the professors of civil engineering of the University of Virginia, the Virginia Military Institute, and the Virginia Agricultural and Mechanical College. The highway commissioner is to receive a salary of $3,000 per annum and traveling expenses, and an assistant to the commissioner is to receive $1,800 per annum and traveling expenses. Clerks and other assistants are also provided for. The sum of $16,000 was appropriated for the use of the commission from July 1, 1906, to February 28, 1908. The commission is to collect and disseminate useful information on road building, to prepare plans and specifications for the improvement of roads throughout the State when requested by local authorities to do so, and to direct the construction of such roads.

The commission is further authorized to furnish as many convicts from the State prison as may be necessary to build the roads according to the specifications of the commissioner and under the direction of an engineer appointed by him, provided the local authorities agree to furnish all necessary material, tools, and teams. The State highway commissioner is authorized to have general supervision of the construction and repair of the main traveled roads throughout the State and to recommend to local authorities and to the governor needed improvements in the public roads. The professors of civil engineering at the universities and colleges mentioned are required to aid the commissioner when not actually engaged in their academic work by inspecting road work and giving such information as may be desired.

Another act, approved March 6, 1906, provides for the use of State convicts in the improvement of public roads and in the preparation of road-building material throughout the State. Such convicts when engaged in this work in any county are placed under the direction of a civil engineer and road builder appointed for the purpose by the State highway commissioner. The sum of $25,000 is appropriated annually out of which to pay the transportation of the convicts to and from the penitentiary and for guarding, clothing, and feeding them when engaged in this work.

The law relating to the establishment, construction, and permanent improvement of public roads was amended March 17, 1906, providing among other things that the county superintendents of roads, road district boards, road subdistrict supervisors, and the State engineer shall have control, supervision, and management of the public roads. The bill also provides that the regular county levy and district levy may be used in defraying the county's and district's proportion of the expense of constructing roads for which State aid has been obtained. Rules and plans for making roads in the counties are subject to the approval of the State highway commissioner.

The boards of supervisors of the various counties, according to an act approved March 14, 1906, are authorized to enact such local legislation as may be necessary for the protection of roads and bridges.

According to an act approved March 8, 1906, bonds may be issued by any county for the purpose of permanently improving roads and bridges, provided the same is agreed to by a majority of the qualified voters of the county. The maximum amount of such bond issue shall not exceed 10 per cent of the total taxable valuation, and the bonds shall be payable in not to exceed thirty-four years. A tax of not to exceed 90 cents on each $100 worth of property must be levied to create a sinking fund and to pay the interest thereon. All roads built from such bond issues must be constructed according to the directions of the State highway commissioner.

Counties in which no special road law is in force may be divided by the board of supervisors into road subdistricts. The qualified voters of such subdistricts are authorized to meet and elect a chairman, secretary, treasurer, and one or more road surveyors and to assess a subdistrict road tax of not to exceed 50 cents on each $100 of taxable valuation. These funds are to be expended under the direction of the road surveyor of the subdistrict and according to such instructions as he may receive from the State highway commissioners, the county supervisors, or the subdistrict meetings. The surveyor is also required to furnish such information to these authorities as may be requested from time to time. The State highway commissioner is required to furnish plans of split-log and other drags to supervisors of subdistricts and to instruct them in their proper use.

An act relating to turnpike companies was so amended, March 17, 1906, as to provide that when the collection of tolls on turnpikes has been suspended for a period of four months on account of the bad condition of the same, three disinterested supervisors shall be appointed by the circuit court to make an examination of the road, and if it is reported by them to be in bad condition the circuit court is authorized to require the turnpike company to forfeit its franchise and charter.

Chapter 43 of the code of Virginia was so amended on March 19, 1906, as to provide that taxes levied for road purposes by the boards of county supervisors shall not be levied on property located in incorporated cities and towns which maintain their own streets.

PROGRESS IN FARM MANAGEMENT IN 1906.

By W. J. Spillman, *Agriculturist in Charge of Farm Management Investigations, Bureau of Plant Industry.*

Progress in the development and extension of agricultural industries and efforts looking toward the adoption of improved methods of farming have been hampered in all sections of the United States during the past year by a lack of farm labor. The amazing development of transportation and manufacturing industries has absorbed the available labor, and the farmer has been compelled to operate with an insufficient supply. Especially in New England and in the Southern States the labor is drifting toward the cities. The State of South Carolina has been making efforts to remedy this difficulty by securing immigration. The State of Maryland is taking steps in the same direction. Modification of our immigration laws has been suggested as a means of ameliorating this condition. It is believed that the present interest in agricultural education will lead to the development of schools of a type that will open the door of opportunity on the farm, and thus hold a larger proportion of the rural population, to some extent remedying the difficulty.

Because of insufficient labor many farmers have been compelled to abandon types of farming which require much labor and to seed much of their land to grass, thus reducing the amount of labor needed, but at the same time reducing the income from the land.

One of the most notable movements in connection with progress in farm management during the past year has been the tendency toward diversified farming in the cotton belt. The primary factor in this movement is the injury done to the cotton crop by the boll weevil. Diversified farming in that section is taking the direction of an increase in trucking and fruit growing, dairying, hay production, the raising of hogs, and to some extent the production of beef. The development of trucking and fruit interests has been greatly hampered because of difficulties connected with the marketing of perishable farm products. On account of the absence of statistics relating to acreages of such crops the farmer has no idea of the acreage of any particular crop it is safe for him to plant. Because of lack of organization for marketing such products, he does not know where to send his material when it is ready for market. The further fact that the producer has no adequate protection against unfair treatment from consignees has discouraged many farmers from engaging in trucking. In some sections icing charges and high freight rates leave no profit to the producer. If these difficulties could be remedied there would undoubtedly be an enormous increase in truck farming throughout the South.

The present effort to eradicate the cattle tick in the South causes renewed interest in all types of cattle farming. If the effort is successful, it will undoubtedly result in a large extension of cattle raising just at a time when range cattle in the West are decreasing rapidly, because of the occupation of range land by settlers on the one hand and the extension of sheep grazing on the other. The elimination of the cattle tick would also doubtless cause a large increase in the dairy industry in the South.

The increased price of wool for the past few years has caused renewed interest in sheep raising in all sections of the country, and the number of sheep on American farms is increasing.

There are still some sections of the country which have not yet been farmed sufficiently long to deplete the original fertility of the soils, and in these sections single-crop systems of farming, especially grain farming, prevail very generally. In at least one notable instance this type of farming has been continued too long and has resulted in marked deterioration of the soil. Just at the present time the owners of the vast wheat fields in the Sacramento Valley are seriously considering a change in their system of farming with a view to building up the fertility of the soil. In the Plains region the change to a more diversified system of farming has made more progress, and where formerly corn and wheat were practically the only crops, alfalfa, sorghum, Kafir corn, and other forage crops are becoming more important, and the amount of live stock on the farms is increasing. In the Dakotas, where grain farming has been the rule, much interest is manifested in dairying, and that industry is beginning to show very satisfactory development in that section.

The recent demonstration of a cheap and effective method of eradicating Johnson grass will doubtless render it possible for that valuable hay grass to be utilized in crop rotations in the South somewhat as timothy is now utilized in the North. Taken in connection with the eradication of the cattle tick, which is now in progress, this fact can not fail to have an important influence on the development of live-stock farming in the cotton belt.

Alfalfa continues to occupy an important place among those crops which are increasing in area on farms in the eastern half of the United States. Its successful culture is having an important influence in modifying cropping systems and types of farming, and where it has become established it has considerably increased the income from the land.

PROGRESS OF FORESTRY IN 1906.

By QUINCY R. CRAFT, *Forest Service.*

The fuller utilization of forest products which characterized the operations of lumbermen in 1906 marked the greatest gain of the year in private forestry. In the work of the National Government and the States remarkable advance was made in the creation, protection, and use of public forests. Eminent success in systematic effort to prevent damage by fire was attained by private owners, the States, and the Federal Service.

That forest preservation has come to be regarded as a matter of deep concern to every citizen is manifest. News of improved methods and their results is published widely by the press, and commented on in wise and vigorous editorials. The reprinting of forest reports entire by the trade journals is now common. In 16 States 30 forest associations are engaged in active propaganda, and the General Federation of Women's Clubs is advancing forestry locally and giving it prominence at State and National meetings.

Private forestry has grown until not only are professional foresters employed regularly by a number of the larger firms, but firms of consulting and contracting foresters supervise cutting operations and guarantee to the owners renewal of the trees desired in the forest. Large users of forest products tend more and more to apply sound methods to the raising of wood crops and to their careful utilization.

BUSINESS FORESTRY IN THE ADMINISTRATION OF THE NATIONAL FORESTS.

Within three decades after the first Federal recognition of forestry, and sixteen years from the date when the first "timberland reserve" was created, there have been established (May 1, 1907), in the interest of the whole people, 150 million acres of National Forests, effectively protected against fire and trespass, and thrown open on advantageous terms to the use of the public. Forests have so large a place in the national life that in some measure every citizen shares the benefits which attend successful effort to preserve, restore, or establish them. Yet it will always be the Western industries which will most profit from the presence of the existing National Forests, upon whose resources—mainly wood, water, and range—they are largely dependent. The Government always favors settlers and home builders and prior users, both by granting free use of timber and by encouraging small sales. The business of the National Forests must increase largely; for so vast are the resources of timber and minerals, and the opportunities for various business enterprises and for the development of power and irrigation, that the utilization of the Forests can be said to have only fairly begun.

Throughout the year marked progress has been made in securing the most prompt, simple, and precise business methods, and in bringing the forest officers in the field and, through them, the public into closer touch with the aims of the Government in its forest policy. On January 1, 1906, the area of the National Forests was 97,773,617 acres, and on December 31, 1906, 127,154,371 acres; but the receipts increased in greater proportion—from $273,660 in 1905 to $1,004,185 in 1906. In addition, 15,000 permittees (near-by settlers and ranchmen) were granted timber free of charge to the value of $75,000. The progress of National Forest administration in business matters is indicated by the following table:

The results of business forestry.

Fiscal year (July 1 to June 30).	Area of National Forests, June 30, 1906.	Total gross revenue.	Total expenditure.	Deficit.	Expenditure per acre.	Deficit per acre.
	Acres.					
1901–2	59,966,090	$25,431.87	$325,000.00	$299,568.13	$0.0054	$0.0050
1902–3	62,962,849	45,838.08	300,013.50	254,175.42	.0048	.0040
1903–4	63,027,884	58,436.19	379,150.40	320,714.21	.0060	.0051
1904–5	85,693,422	73,276.15	508,886.00	435,609.85	.0059	.0050
1905–6	106,999,138	767,219.00	979,519.00	212,300.00	.0091	.0020

In disposing of timber on the National Forests, every effort has been made to meet the local conditions in each Forest and in the different parts of each Forest where the character of the timber and the market require special consideration. This has been done not only by varying the size of the trees which are cut under the sales in accordance with the kind of timber and the situation, but also by supplying the needs of the people in each vicinity with the particular kind of timber required by them in their industries.

The institution of a charge for grazing in the Forests, with the adoption of regulations to prevent damage to the range, and with satisfactory allotments of territory, both between the cattle owners and sheep owners and between individual owners of the same kind of stock, were important accomplishments of the year.

Planting operations are at present centered in 8 nurseries within or near as many different forests. There are now on hand a total of 6,000,000 seedlings, and 750 acres will be planted in the spring of 1907. Four of the nurseries have been established long enough to grow seedlings of size for planting. Three, those at Fort Stanton and near Las Vegas, N. Mex., and near Pocatello, Idaho, have recently been established. In addition to these many small nurseries have been placed at rangers' headquarters, some of which will be enlarged into planting stations.

Better facilities for communication, through public and private telephone lines now being constructed and the improvement of roads, will be of the greatest assistance in the conduct of forest business, and especially in the control of fires. The use of the forests by the public will also be stimulated by the marking of roads and trails, giving the direction and distance to the nearest town, ranch, or camping place.

The record of 1906 has confirmed the business success of the Government policy, and thus given encouragement to the development of the technical side of forestry. When, through studies now under way, a better knowledge of the growth and habits of our western trees is secured and the forests have been brought, through the utilization of ground at present unoccupied, to greatly increased productiveness, still larger benefits may be expected.

MOVEMENT WESTWARD AND SOUTHWARD OF THE LUMBER INDUSTRY.

Where lumbering methods remove only mature trees or an annual cut equal to the aggregate growth of the forest tributary to the mill, forest products, like field crops, must increase as operations extend. The din of the lumber camp and the mill, and the whistle of the locomotive and steamboat hurrying their product to market, will then announce not the passing of the forest but its preservation through use. When, on the other hand, lands are denuded and left waste, deeper penetration into the woods with the enlarged capacity which comes of skill and invention can only hasten the exhaustion of supply.

Too much wasteful exploitation has made heavy inroads in the forest which once stretched almost unbroken from the Atlantic to the prairies. In obedience to the law of supply and demand, lumber prices have gradually advanced in the past twenty years, in some cases (fig. 21) as much as 108 per cent. Yet these advances have not kept pace with those of stumpage values, and do not, therefore, fully reveal the changed condition in the timber supply. These changes show conclusively that it is high time for the introduction of conservative forest methods in the management of woodlands everywhere. There are now a million acres of private woodland on which forestry is being applied under plans prepared during the past four years by the Forest Service; but this is only a beginning. The scope of this management must be increased many fold.

To supplement and complete the statistics of forest products there is great need for accurate knowledge of the standing timber in the country and its stumpage value. Sizes and species are now used which formerly were left as unmerchantable, so that all former estimates are out of date. Any future estimate of timber should leave out of consideration the present merchantable value of timber, and should aim to show the actual stand of timber regardless of size, species, or quality. The inadequacy of former estimates is shown by a single instance in which the coniferous cut since 1880 has exceeded by 80 billion feet the total estimated stumpage of those woods at that time. And this is not only because of the scarcity of better grades and larger sizes, but also because of the improvement of forest methods, largely brought about through the application of forestry.

PRIVATE FOREST LANDS THE MAIN SOURCE OF SUPPLY.

The Nation can and should maintain forests in isolated and mountainous regions where their principal value is for the protection of watersheds, the sources of streams, and the many industries dependent upon an equable supply of water and a sufficient range. But on private lands the practice of forestry can be expected only where it

insures profit in perpetuating a source of timber supply. Since four-fifths of the forests of the country, and, in general, those most productive and accessible, are in the hands of private owners, the future timber supply rests chiefly with them. Timberland owners are realizing this fact. In the eastern part of the country forests under management are now so numerous that some one of them can be visited for inspection by a few hours of railway travel. On the Pacific coast the necessity of protection from fire is especially felt; and a lumber company in northern California is successfully carrying out a plan for fire protection on a tract of 70,000 acres and at a nominal cost.

At no previous time have the prospects for success in private forestry been so good. Depleted supply encourages conservative use, and increased knowledge of the less familiar forest trees, of improved methods of management, of seasoning and kiln-drying methods, and of markets, enables the lumberman or landowner to lay his plans with a confidence hitherto impossible.

More and more is the entire tree being utilized, by cutting the trunk nearer the ground and higher into the crown; by the use of modern equipment which secures the minimum of waste at the mill; and, in the hardwood regions, by the construction of charcoal blast furnaces and chemical plants to utilize the bark, limbs, edgings, slabs, and even the sawdust in the manufacture of charcoal, wood alcohol, and acetate of lime.

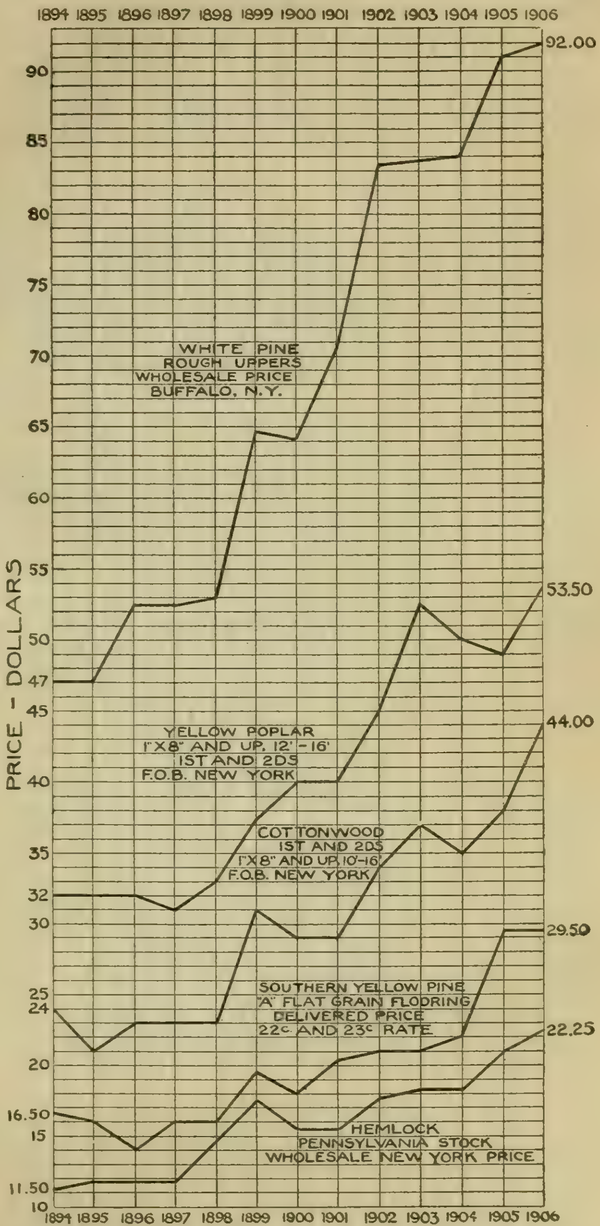


FIG. 21.—Rise in prices per thousand feet of different kinds of lumber, 1894–1906.

MORE EFFECTIVE CONTROL OF FOREST FIRES.

The first essential at all times to successful forest management is protection from fire. There are reasons for believing that decided gains have been made toward solving

this perplexing problem. Reports from State fire wardens, from National Forest supervisors, and from those engaged in systematic effort to prevent fires from gaining headway on private lands, give renewed confidence as to the effectiveness of the measures employed. In Michigan the loss during the year was estimated at $460,000, and in Idaho, Washington, and Oregon it was also heavy; but throughout the country in general, loss from this cause, of timber standing and in the mill, has been comparatively light. In the National Forests the area burned over was 115,416 acres, or 0.12 of 1 per cent of the 97,000,000 acres from which reports were received. Thus, even as compared with the excellent record of 1905, when the area burned over was 0.16 of 1 per cent, a gain in efficiency of one-fourth was made.

RAILROADS AND MINE OWNERS APPLY FORESTRY.

For four years railroads have been cooperating with the Government in investigating the present tie supply, the possibilities of planting trees for ties, and methods for prolonging the life of ties through mechanical devices to lessen wear and through preservative treatment. Studies in seasoning and preservation have enabled railroads in the Northwest to use lodgepole pine as tie timber, and have stimulated the building of treating plants by railroads in the Mississippi Valley. Other roads, through the advice of the Forest Service, have begun planting on a large scale. One of these, the Pennsylvania, is the first to appoint a forester to supervise the care and planting of the company's forest lands. Already 500,000 trees have been planted; and 681 acres of land near Altoona, Pa., will be stocked with chestnut and white oak in the next two years. The Santa Fe Railway has recently purchased 8,330 acres near San Diego, Cal., on which to grow timber for its own use. A tract of 2,600 acres will be planted to eucalypts. The Lehigh Coal and Navigation Company will plant 378 acres in Carbon and Schuylkill counties, Pa., with chestnut, European larch, and Scotch pine. The Delaware and Hudson Company was led by the results of a cooperative study with the Forest Service to appoint a forester to look after the extensive woodlands of the company and attend to the planting work.

The Philadelphia and Reading Coal and Iron Company has been investigating how mine props may be made to last longer through impregnating with creosote by the "open-tank" treatment. Mine props cost this company alone nearly a million dollars a month. The results of this treatment are so satisfactory that plans have been made for the erection of a plant, with a capacity of about 800 cubic feet a day, with which to continue the treatment on a commercial scale. This work has shown the economy of the open-tank treatment and encouraged its wider use.

SOME PROJECTS OF THE FOREST SERVICE.

A planting plan was recently prepared for a tract of 800 acres on an island in the Cimarron River in Oklahoma. The owner desires a crop of posts and poles of quick-growing and durable wood, and for this purpose in that region black locust was recommended. It is designed that the tract shall eventually form a pleasure resort for the city of Enid, from which it is 20 miles distant.

Unusual interest in forest methods has recently been manifested by companies engaged in redwood lumbering in California. A plan prepared for a tract of 15,000 acres, which provides for planting eucalypts on cut-over redwood lands, has been put into execution. The eucalypts, besides growing one or more crops while the redwood is maturing and thus hastening the returns on the investment, will in the competition for growing space assist the redwood to form long, branchless trunks. Where the tempering influence of the coast fogs is felt, conditions are ideal for the growing of eucalypts suitable for lumber, and, because of the lack of other hardwood timber, a good market is promised. The indications are that similar plans will be adopted by other companies.

An improved system of map files has been introduced with a central equipment, known as the Forest Atlas. By this means maps containing all available data, topographic, political, industrial, and geological, are filed flat in compact form in dust-proof and fireproof cases, indexed for ready reference. Forest and grazing conditions are noted in the fullest detail. At the headquarters of every forest supervisor will be filed atlas sheets relating to the Forests under his administration.

During the year the Forest Service has made examination of 54 timber tracts, located in 25 different States, aggregating 2,288,132 acres; and of 70 woodlots with a total of 6,255 acres.

Through an investigation of the piling used in wharf construction, data have been secured showing the enormous loss resulting from marine borer attacks and the inefficiency of present protective measures and the possibility of cheapening and improving them.

Timber tests for several months have been chiefly concerned in determining the strength and other physical properties of Douglas fir, western hemlock, loblolly pine, Norway pine, and tamarack, in such forms as car sills, bridge stringers, and other structural timbers. Tests of eucalypts indicate that they can be used as substitutes for hickory and oak for many purposes.

In cooperation with the Northern Pacific Railway, experimental sections of track are being laid to study the influence of different methods of handling timbers. Tests are to be made of the rate of seasoning of timbers cut during different months, to determine the relation between the season of cutting and rate of absorption of preservatives, and to determine the comparative durability of seasoned, treated, and green timbers in use in the track. The species used are Douglas fir, western tamarack, western hemlock, and giant arborvitæ.

Studies of the requirements and adaptability of wood for specific uses promise a saving in the substitution of new woods. Further economy has been found possible in the use of sound dead and down timber on the National Forests. The lumbermen and the Forest Service have been brought into closer touch through cooperation in compiling a report seeking to assist in the standardization of grading rules and detailed classified statistics of forest products. Experiments in turpentining have shown that the economy effected by the cup and gutter system may be increased by reducing the wound made in chipping. Trees shallowly chipped according to the new method produce at least as much resin and of better quality for a much longer period with remarkable saving as a result.

FORESTRY IN THE STATES.

Forest work carried on by the States made greater advance during 1906 than in any previous year. More than 20 States now have forest officers, and 10 have State forest reservations (fig. 22). In Wisconsin the State forests, comprising 254,072 acres, are scattered through 17 counties, situated north of a line from St. Paul to Green Bay. Isolated lands are being sold and lands purchased contiguous to the main body on the headwaters of the Wisconsin. Within the boundary of the Catskill Preserve in New York there are 92,708 acres of State lands and 483,412 acres privately owned; the total area of the Adirondack Preserve is 3,313,564 acres, of which the State now owns 1,347,280 acres. The Hawaiian reserves include an area of 300,000 acres, of which the Territory owns nearly half, but all is managed under plans prepared by the Superintendent of Forestry.

In 5 States—Connecticut, New Jersey, Pennsylvania, Michigan, and Wisconsin—the removal of mature timber from State forest lands is now permitted, a provision which is a fundamental principle of forestry.

In Nebraska, Iowa, Maine, and Mississippi additional data concerning State forest conditions have been secured through studies conducted by the professor of forestry at the State college or university. It is the duty of the State forester in Maryland and Massachusetts to give a course of lectures each year at the State agricultural college, and in Wisconsin at the State university.

The University of Texas is still engaged, with the Forest Service, upon a study of the State's forest resources; in a similar cooperative study, the Missouri State Experiment Station has just completed an investigation of the timber resources of the Ozark region; the Kentucky legislature last March provided for a commissioner of forestry, and appropriated $2,000 to be expended in a cooperative study of the State's forests.

A year and a half have enabled the State forester of California to organize fire patrol in 10 counties, as well as to interest a large number of associations and clubs in fire protection and to prepare a large planting plan for a eucalyptus plantation on cut-over redwood land at Fort Bragg. Fire wardens to the number of 367 have been appointed, and 30 miles of fire lines, from 30 to 60 feet wide, have been cleared, encircling the Redwood Park.

The chief progress during the year in Connecticut was the organization under the new law of a fire-warden service of 300 members. This service was instrumental in extinguishing 64 fires at an average cost of $7.50 and in largely reducing the loss through forest fires. The feeling of increased security from fire resulted in more forest planting in Connecticut than was ever done before in a single year. Under the direction of the State forester, 150,000 trees were planted by the State and private owners.

The Delaware State Experiment Station, in cooperation with the Forest Service, is making a study of forest conditions on which to base recommendations for a State forest policy and plans of management for different stands of timber and different classes of land.

FIG. 22.—Map of State forest reservations.

Area and location of State Forest reservations.

State.	Name and location.	Area.	Total area.
		Acres.	*Acres.*
Connecticut	1. Portland Tract, Middlesex County	1,060	
	2. Union Tract, Tolland County	300	
			1,360
Hawaii	1. Kaipapau, Oahu	913	
	2. Hamakua Pali, Hawaii	16,133	
	3. Hilo, Hawaii	12,771	
	4. Koolau Maui, Maui	14,300	
	5. Halelea, Kauai	10,990	
	6. Kealia, Kauai	7,385	
	7. Ewa, Oahu	4,768	
	8. Honaunau, Hawaii	665	
	9. Kau, Hawaii	35,900	
	10. Waianae-kai, Oahu	3,150	
	11. Lualualei, Oahu	3,743	
	12. Hana, Maui	6,754	
			117,532
Indiana	State reservation, Clark County		2,000
Maryland	1. State reserve, Garrett County	3,500	
	2. State reserve, Baltimore County	40	
			3,540
Michigan	State reserve, Roscommon and Crawford counties		39,000
Minnesota	1. Burntside Forest, St. Louis County	20,000	
	2. Pillsbury Tract, Cass County	1,000	
	3. Itaska State Park, Clearwater, Becker, and Hubbard counties	21,800	
			42,800
New Jersey	1. Mays Landing Tract, Atlantic County	373	
	2. Bass River Tract, Burlington County	1,550	
	3. Blairstown Tract, Warren County	551	
			2,474
New York	1. Adirondack Preserve, Clinton, Essex, Franklin, Fulton, Hamilton, Herkimer, Lewis, Oneida, St. Lawrence, Saratoga, Warren, and Washington counties	1,347,280	
	2. Catskill Preserve, Delaware, Greene, Sullivan, and Ulster counties	92,708	
			1,439,988
Pennsylvania	State reserves, Adams, Bedford, Cameron, Center, Clearfield, Clinton, Cumberland, Dauphin, Elk, Franklin, Fulton, Huntingdon, Juniata, Lackawanna, Lycoming, Mifflin, Monroe, Pike, Potter, Snyder, Tioga, Union, and Wyoming counties		820,000
Wisconsin	Forest reserves, Ashland, Bayfield, Burnett, Douglas, Florence, Forest, Gates, Iron, Langlade, Lincoln, Marinette, Oneida, Polk, Price, Sawyer, Vilas, and Washburn counties		234,072

In the Territory of Hawaii a state nursery supplies plant material free for schools and other public purposes and at a low price for private use. District foresters and district

FIG. 1.—TRANSPLANT BEDS OF NURSERY AT SARANAC INN, N. Y. NORWAY SPRUCE, 3 YEARS OLD, IN THE FOREGROUND; SCOTCH PINE TO THE LEFT.

FIG. 2.—SCOTCH AND WHITE PINE, 5 YEARS OLD, IN THE LAKE CLEAR PLANTATION.

SUCCESSFUL EXAMPLE OF PLANTING DENUDED STATE LAND.

fire wardens have been appointed, who report regularly to the superintendent of forestry.

The Indiana forest commission has been engaged on a study of the natural and planted forests of the State. The results, which have been published and distributed, should greatly stimulate the practice of forestry. Trees have already been planted on 300 acres of the State reservation, and 57,000 more trees are to be transplanted from the State nursery this spring.

The Kansas commissioner of forestry is gathering statistics of forest planting through annual reports from those to whom stock has been furnished.

The commissioner of forestry of Louisiana, in the enforcement of the forest law passed in 1904, gives first attention to the suppression of fires.

The class in forestry in the University of Maine made a study of forest conditions in Indian Township, Washington County, a tract of 24,072 acres of State land, securing data for a map and an estimate of the stand of timber. Facts concerning the growth of large-tooth and trembling aspen and gray birch were also secured. A study of woodlot management, now in progress, aims to learn the best methods of marking trees and the cost of cutting and yarding logs and of piling and burning the brush.

On July 1 a forester was appointed by the newly created Maryland board of forestry. A portion of the autumn was spent in making a reconnaissance of the forest lands of the State.

Forest work in Massachusetts is carried on along three general lines—education, the installation of typical plans of management, and the gathering of technical data. Effort is being made to assist landowners in transforming large areas now practically idle on account of mismanagement into profitable woodlots. Fifty-five students took the course in forestry at the agricultural college last year.

Marked progress was made in Michigan in improvements, surveys, fire lines, and planting on the State forest reserve. Forty acres were seeded to western yellow pine last spring and 200,000 conifers were planted. Two and a half million seedlings are now on hand in the nursery.

Through the splendid efforts of a volunteer patrol the excellent fire law of Minnesota was made effective in keeping forest fires well under control. The damage for the year is placed by the State fire warden at $10,000.

Two experimental forest nurseries and a study of actual profits in the eastern part of the State will increase the knowledge of the possibilities in forestry in Nebraska, the leading tree-planting State.

New Hampshire occupies a unique position in that besides the State forestry commission, reorganized and active, it has a forest association, which maintains a State forester.

A State fire warden and 70 township wardens have been appointed in New Jersey under the law which became effective July 1, 1906. The fall season was remarkably exempt from serious fires. At the beginning of the year 1907 a State forester was appointed, who will give assistance to private landowners, give courses of instruction to teachers and farmers, and cooperate with the State fire warden and with the Forest Park Reservation Commission.

Under the law of 1905 the superintendent of forests of New York was able to patrol the State preserves efficiently during the dry season at small expense. To supply stock for planting in the preserves the State maintains 3 large nurseries for conifers in Franklin County and 1 for hardwoods in Ulster County, in the Catskills. The three Adirondack nurseries combined have a capacity of a million 3-year-old transplants per annum. One of these, the Saranac Inn Nursery (Pl. XLIII, fig. 1), was established by the State in 1903 and the others, Axton and Wawbeek, were first established by the Cornell College of Forestry and were placed in charge of the State forest commission in the spring of 1906. Five plantations, embracing an area of 1,500 acres, have been planted. (Pl. XLIII, fig. 2.) In 1905 and 1906, 50 acres of pines and spruces were planted by the seed-spot method, with encouraging results. Broadcast sowing last March of white pine, red spruce, and balsam was not satisfactory. An interesting experiment is being conducted with 5 species of Siberian conifers—pines, fir, and larch—to determine their fitness for planting in the North Woods.

In Ohio the department of forestry at the State Agricultural Experiment Station was engaged in cooperative work in planting with the farmers of the State. Plantations aggregating 500 acres were thus established.

The State nurseries of Pennsylvania were doubled in size in 1906 and now comprise 6 acres at Mont Alto, the location of the State forestry academy, and 2 acres in Huntingdon County. Last spring 160,000 white pine seedlings were set out, and 400 pounds of white pine seed is to be planted this spring. The last legislature voted to expend $400,000 annually for five years in purchasing additional State forest lands.

In Vermont planting of waste lands is being encouraged by the commissioner of forestry, who estimates that there are 4,000,000 acres of land now unproductive, but

suited to the growing of timber. These, if rightly handled, he asserts, would give an annual income of from $1 to $2 per acre. From the State nursery at Burlington plant material will be supplied at cost. Through cooperation with the New York forest commission the assistance of a trained forester is secured.

The appropriation of $25,000 by the Washington State legislature was exhausted at the beginning of the forest-fire season of 1906. The action of the lumbermen of the State in coming promptly to the rescue of the State fire warden with individual subscriptions of funds ample to defray the expenses of patrol until the next session of the State legislature is one of the encouraging evidences of a practical belief in forest protection.

Over 300 fire wardens have been appointed in Wisconsin, whose services were secured at a cost for the season of $1,530. They report 160 fires, which burned over 76,125 acres. Sixty per cent of the fires were caused by settlers in clearing and burning for pasture. With lessened danger that their investments will be swept away by fire, lumbermen have begun to limit the diameter to which they cut, and to buy young growth and protect it from fire.

Since Rhode Island, during the past year, passed a forest law and appointed a forester, all of the New England States—indeed, all but three of the original thirteen—with an area equal to that of the National Forests in the Western States, are equipped with State officers charged with the welfare of their forest interests. Westward this chain extends, including Ohio and Indiana, and the three Lake States which for twenty years have furnished one-third of the lumber produced in the country.

FOREST LEGISLATION.

Only a few of the State legislative assemblies were in session during the winter of 1905–6, and in consequence there was but little additional legislation enacted. The laws passed are briefly summarized as follows:

United States.—Agricultural settlement was permitted in restricted portion of Yellowstone Reserve (34 Stat., 62). Appropriations for agricultural experiment stations in the States and Territories were increased to $30,000 each, the added income to be used at discretion in forest experiments (34 Stat., 63). A grant was made to Edison Electric Company of easement to occupy land in San Bernardino, Sierra, and San Gabriel National Forests for power plants (34 Stat., 163). Cutting, chipping, and boxing trees on public lands was prohibited (34 Stat., 208). Appropriation or destruction of American antiquities was prohibited, except under certain conditions (34 Stat., 225). The Secretary of Agriculture was empowered to list lands within National Forests as agricultural for entry under homestead laws (34 Stat., 233). Recession by California of Yosemite Valley and Mariposa Big Tree Grove was accepted (34 Stat., 831). Lands were granted to Wisconsin for forest reserves (34 Stat., 517). The President was empowered to set aside game preserves in Grand Canyon (34 Stat., 607).

Iowa.—Taxes on "private reserves," under certain conditions, were fixed at $1 per acre, fruit-tree reserves included. Secretary of the State horticultural society was designated to be State forester, and authorized to have deputies (Ch. 52, additional to code, Ch. 1, tit. 7).

Kentucky.—The State board of agriculture, forestry, and immigration was empowered to act as forestry commission. This board is permitted to expend $2,000 to further forest interests, this money to be spent in cooperation with the Federal Government, if the latter provides a like sum (Ch. 90, repealing S. 37 and 38, Ch. 4, Ky. Stat.).

Maryland.—The State board of forestry was created; the appointment of a forester was provided for; this official was authorized to have general protective power over parks and forest reserves, to cooperate with corporations and individuals, and to appoint fire wardens, the latter to force service from inhabitants, when necessary, to fight fire. An appropriation was made of $3,500 annually for 1907 and 1908, and penalties are to be paid to the forest-reserve fund. Counties are empowered to spend money in forest protection and to recover from land owners for expenses in fire fighting. Fire warnings are to be posted; criminal and civil liability was provided for unlawful fire building; offenders are also to be liable to the State and county for fire-fighting expenses; locomotives not burning oil are to be equipped with fire-preventing appliances, under penalty (Ch. 294).

New Jersey.—State board of forestry was authorized to cooperate with municipalities, corporations, and individuals for control of forest land, for establishment of

an arboretum, and for experiments in forest culture (Ch. 25). The commissioners are to fix price and contract for the purchase of forest reserve land. Municipalities are empowered to use their land for forest purposes, to sell timber, to contract with State board of forest park commissioners for control and management of land, lands so used being declared devoted to public use (Ch. 146). The State fire warden is to be appointed by the State board, and the fire warden system was established. Compulsory service of male inhabitants and property, with remuneration, was authorized. Provision was made for, and allotment was made of, fire-fighting expenses; fire warnings are to be posted; large fires are to be reported to the State warden; the season for brush burning was limited; fires must be watched; back firing is allowed under certain conditions. Process, appeal, and execution in fire cases were provided. Money was appropriated (Ch. 39, acts 1902) to be used solely for fire fighting (Ch. 123, repealing or amending a number of former acts).

New York.—State forester is authorized to appoint a secretary. Salaries of subordinate officers are fixed (Ch. 206, amending S. 154, 172, and 224a, Ch. 20, laws 1900). Commissioners are empowered to appoint a chief fire warden and five inspectors (Ch. 519, amending S. 224a, Ch. 20, laws 1900).

Ohio.—A department of forestry at the agricultural experiment station was created, to cooperate with the Federal Government. The State forestry bureau connected with the State University was abolished (P. 54).

Rhode Island.—Office of State forester was created forester to publish information and to recommend legislation (Ch. 32).

GAME PROTECTION IN 1906.

By T. S. Palmer, *Assistant, Biological Survey*.

The record of game protection in 1906 is noteworthy in several respects. New legislation, while small in volume as compared with that of 1905, included several important measures. The question of Federal control of the protection of migratory game birds again attracted widespread attention and was the subject of much discussion. More than the average number of cases based on game laws were decided by courts of last resort. In the establishment of game preserves under private, State, and Federal auspices notable progress was made. The destruction of quail by the severity of the two preceding winters resulted in large shipments of these birds from Alabama and the Southwest in the effort to restock some of the Northern and Eastern States. Experiments were continued also in introducing new game birds, and English pheasant eggs and gray partridges were imported from Europe in unusually large numbers.

LEGISLATION.

Game legislation in 1906 was remarkable for the unusual number of bills under consideration by Congress and the small number of changes in State laws. The Federal laws enacted comprised acts authorizing the Secretary of the Interior to lease 3,500 acres of land in South Dakota as a buffalo preserve, prohibiting trapping or trespass on bird refuges, establishing a game refuge on the Grand Canyon National Forest in Arizona, and prohibiting hunting in the greater part of the District of Columbia. An appropriation of $15,000 was made for the erection of a fence for a buffalo inclosure on the Wichita Game Preserve in Oklahoma.

Only 15 States and 8 provinces held regular legislative sessions during the year, and the number of new laws enacted was about 60, including 7 in Canada, while the total number of bills introduced in the United States and Canada exceeded 150. The most important measures adopted were entire new game laws in Mississippi, laws protecting nongame birds in Iowa, and radical amendments to the sale laws in Massachusetts. The failure of all general game bills and the passage of 18 local measures in Maryland showed that the system of county laws is still preferred, but the local acts passed tended in general toward greater uniformity in seasons. The only changes in hunting license fees were the establishment of a $25 nonresident license in South Carolina and a $20 nonresident license in Mississippi, both good only in the county of issue. In Vermont the nonresident license was extended to include birds, and in Maryland minor changes were made in the license laws of the counties bordering the Patuxent River and of Somerset County. Important sale restrictions were adopted in Mississippi and Massachusetts. In the former State the sale of all protected game was prohibited and in Massachusetts sale of imported quail was prohibited except in November and December, sale of imported ducks except during the open season, and

the sale at any time of prairie chickens and sharp-tailed grouse. For the first time in Mississippi a game-warden service was installed by providing for the appointment of county wardens to look after the enforcement of game laws in place of sheriffs and local peace officers.

Among the numerous bills which failed to pass were some measures of special interest. Ten of the 11 bills introduced in Kentucky failed to receive favorable consideration, and in Massachusetts only 10 of the 30 bills introduced became laws. Bills to prohibit the use of automatic shotguns in hunting game in the District of Columbia, Georgia, Massachusetts, Mississippi, New Jersey, New York, Ohio, Rhode Island, and Virginia were introduced, but none received favorable action. The general game bill in Maryland contained a provision making it lawful to kill cats found searching for birds. Three special cat bills were introduced also in Massachusetts. One of these declared a cat to be property if it wears a collar with the name and residence of the owner, another provided a penalty for abandoning cats, and a third made it an offense to harbor cats known to kill game or wild birds. Among the 10 bills which failed in Virginia were two to create the office of State game commissioner and others providing for a $100 nonresident license and a $1 resident license.

DECISIONS OF THE COURTS.

The decisions rendered by courts of last resort in cases affecting game were more numerous than in 1905, and although none of the questions decided were especially novel, several, affecting sale, duties of common carriers, and rights of hunting and fishing clubs, were of considerable interest. Probably the most important decision of the year was that rendered in February by the court of appeals of New York (People ex rel. Silz *v.* Hesterberg, 76 N. E., 1032) involving the sale during the close season of certain game birds imported from Europe. In this case the contention of the State, first maintained in 1875, that imported birds were subject to the restrictions of the local laws to the same extent as birds captured in the State was upheld. The decision is important also in being the first construction of a higher court of section 5 of the Lacey Act relative to imported game. In line with the same decision was one rendered by the supreme court of New York in October in the case of People *v.* Waldorf-Astoria Hotel Co. ("Forest and Stream," LXVII, p. 687). In Arkansas the supreme court of the State held (Wells-Fargo Express Co. *v.* State, 96 S. W., 189) that the fact that an express company did not know the contents of a package containing game was no defense in a prosecution for transporting game out of the State, particularly as common carriers were authorized by the law of that State to open and examine any package suspected to contain game. An important decision confirming the rights of the Big Lake Shooting Club, at Big Lake, Arkansas, was rendered by the United States circuit court of appeals (Harrison *v.* Fite, 148 Fed., 781). This club, controlling a preserve of some 25,000 acres in Mississippi County, Ark., obtained from the United States circuit court an injunction, which was sustained by the circuit court of appeals, preventing one Harrison and 36 others from shooting on the club's preserve. In Colorado, a decision in a suit by the State for the possession of deer hides, following Hornbeke *v.* White (76 Pac., 926), held that a person having them must establish affirmatively that his possession is lawful (People *v.* Johnson, 88 Pac., 184). In Louisiana a decision of interest to club members was rendered in the case of Burns *v.* Crescent Gun and Rod Club (41 So., 249), in which it was held that the club owning land bordering a navigable stream could be enjoined from preventing persons not members of the club from fishing in such stream. The comprehensive game law enacted in Missouri in 1905 was the subject of more or less litigation and at least three cases were carried to the higher courts. In one of these, State ex rel. Rodes *v.* Warner (94 S. W., 962), it was held that the provision directing fines to be paid into the State game fund was in conflict with the constitutional provision that all fines be paid into the county school fund and to this extent was void. In the others the provisions relating to resident licenses gave rise to two opposite constructions, the St. Louis court of appeals holding that a person was not required to obtain a license to hunt in the county of residence (Ex parte Helton, 93 S. W., 913) and the Kansas City court of appeals holding that such a license was necessary (State *v.* Koock, 96 S. W., 721). In North Dakota the marking provision of the Lacey Act was construed by the Federal court in United States *v.* Thompson (147 Fed., 637). In Oklahoma one of the first decisions affecting game rendered by the supreme court sustained the right of the Territory to impose fines on any carrier, or its agents, for reception and possession of game for transportation (Cameron *v.* Territory, 86 Pac., 68).

Among the numerous cases in the lower courts are three worthy of mention. One was a decision of the circuit court of Muskingum County, Ohio, based on technical errors, but indicating the opinion of the court that the game law, prescribing an open

season for quail "from the 15th day of November to the 5th day of December," should be construed as excluding November 15 and including December 5. The other two were Pennsylvania cases in which juries acquitted a defendant charged with killing a bear in close season on the ground that his action was required by self-defense, and also a game warden charged with homicide for killing a game-law violator who resisted arrest.

ADMINISTRATION AND ENFORCEMENT OF LAWS.

Officials.—Changes occurred in the personnel of several of the State game commissions, including the State warden of Maryland and the warden of the first district of North Dakota, the secretary of the Delaware Game Protective Association, and the president of the North Carolina Audubon Society. The board of game commissioners of New Jersey lost one of its members through death. In Canada the office of game inspector was established in Prince Edward Island.

Changes among the deputy wardens were numerous, but whether or not the total force of officers on duty was increased is uncertain through lack of statistics of former years for comparison. A census of 30 States and Territories showed that about 20 States maintained regular salaried wardens, the number of deputies varying from one in Iowa to 65 in New York and 88 in Wisconsin. The number of deputies serving without salary varied from 3 in Wyoming to 800 in Colorado. The total number of wardens on duty in these States during the latter part of the year, as shown in the following table, was 370 under salary, 489 paid per diem, and 4,914 serving without salary; in all, a total of 5,773.

Table showing number of game wardens on duty in 30 States in 1906.

State.	Salaried.	Per diem.	Without salary.	Total.	State.	Salaried.	Per diem.	Without salary.	Total.
Arizona			63	63	New Jersey	24		167	191
California	12		350	362	New Mexico			67	67
Colorado	6		800	806	New York	65		450	515
Connecticut		142		142	North Carolina	8	44		52
Delaware		1	6	7	North Dakota			78	78
Florida	[a] 17			17	Oklahoma			26	26
Illinois	10	150		160	Pennsylvania	8		165	173
Indiana	15	10	75	100	Rhode Island		4	40	44
Iowa	1		250	251	Utah	22		132	154
Kansas		8	292	300	Vermont		16	463	479
Maine		40		40	Washington	34	1	200	235
Maryland	5		229	234	West Virginia			38	38
Massachusetts	16	9	244	269	Wisconsin	88			88
Minnesota	24	39	56	119	Wyoming	3	25	3	31
Montana	8		210	218					
Nebraska	4		510	514	Total	370	489	4,914	5,773

[a] County wardens; there are many deputies not listed as the information was not obtained in time.

Convictions.—Convictions resulting in heavy fines were reported in at least 10 States. The following cases illustrate the character of offenses for which fines of $100 or more were imposed: In Colorado, for killing a mountain sheep $300 fine and $140 costs; in Illinois, possession of game in close season $100, killing 4 quail in close season $100 and costs, two nonresidents hunting on resident licenses $100 and costs, illegal shipment of quail $200; in Michigan, for illegal shipment of venison $100 and costs and 60 days in jail; in Minnesota, illegal possession of 2 saddles of venison $115 and costs, shipping deer from the State in excess of limit two fines of $100 and $147; in New Jersey, for possession of 4 blue jays $100 and costs, possession of 5 robins $100 and costs, possession of 4 robins and 1 thrush $100 and costs, possession of 5 birds $100 and costs; possession of 6 birds $120 and costs; in New York, for violation of the anti-hounding law $200 and costs, illegal possession of 4 deer $200, illegal possession of quail $110 and costs or total of $290, possession of grouse and quail out of season $600; in five cases, offenses not specified, fines of from $100 to $550; in Oklahoma, for shipping 30,000 quail $350 and costs; in Oregon, for serving birds out of season $100; killing deer contrary to law two fines of $100 each, three of $125, and one of $250; in Pennsylvania, for removing wild turkey chicks from the nest $250; in Vermont, for killing deer contrary to law seven fines ranging from $100 to $177 each.

In a number of cases the defendants were committed to jail in default of payment and in a few instances received a jail sentence in addition to a fine. Among the cases resulting in imprisonment were the following: In Illinois two defendants each of whom had killed a prairie chicken were committed to jail for 10 days for failure to pay fines,

one defendant was committed to jail for killing a pheasant, three for hunting without a license, one for hunting before sunrise, and another for killing quail out of season. In Michigan two defendants received a sentence of 60 days in jail and $100 fine each for attempting to ship venison out of the State, and another for shipping venison to market. In New Jersey one defendant was sentenced for 10 days for illegal possession of a blue jay, and another 10 days for killing one partridge; in North Carolina one defendant was imprisoned 30 days for hunting on land without permission in Davidson County; in Oregon one offender received a sentence of 12½ days for trapping beaver, and two other defendants were committed to jail in default of payment of fines for killing deer out of season; in Pennsylvania two aliens were sentenced for 370 and 400 days, respectively, for hunting without licenses and killing song birds; and in Texas two men were sentenced to jail, one for 10 days and the other for 30 days, for illegally trapping and shipping quail.

Aliens.—The violation of the game laws by aliens was the subject of special comment in the reports of several State game commissions, particularly those of Maine, Pennsylvania, and West Virginia. In Pennsylvania the commission reported that they had 14 officers shot at during the year, 7 shot, 3 of whom were killed, 3 very seriously wounded, and one other although not serving under a commission of the board was killed while in performance of game protective duty. All of this work was done, so far as could be determined, by unnaturalized foreigners. As a result of these conditions the commission recommended the adoption of a law similar to that passed in New York in 1905 prohibiting aliens from carrying firearms, as a matter of greater protection to the game and also as a measure of public safety.

Indians.—An invasion of Wyoming by Indians from Colorado during the summer resulted in serious consequences to the game. Two bands of Utes, each about 500 in number, entered the State in the latter part of July and the first week in August and penetrated some distance northward in Converse, Weston, and Crook counties. The Indians were well armed and stripped the country of game wherever they traveled, slaughtering hundreds of sage hens, scores of antelope, and many deer. The game wardens and local authorities were utterly powerless to prevent these depredations, and it was only by the aid of Federal troops that the Indians were finally rounded up and returned to their reservation.

Tusk hunters.—The demand for elk tusks was responsible, as in former years, for the destruction of many elk. In Washington a few Indians from the Quinault Reservation were engaged in killing elk for tusks in the Olympic Mountains, but through the efforts of the Indian agent the practice was promptly stopped. On November 20 an important seizure was made at Los Angeles, Cal., of a carload of trophies, comprising the heads, skins, scalps, and horns of many elk killed in Wyoming and on the border of the Yellowstone National Park, and shipped from Idaho to a taxidermist in Los Angeles. Two of the shippers were arrested while unloading the car. At the preliminary hearing it was shown that they belonged to a party of four notorious tusk hunters who had been operating in western Wyoming, north of Jackson Hole, and along the southern border of the park. In default of bail they were committed to jail to await the action of the Federal grand jury in April, 1907.

ORGANIZATIONS FOR THE PROTECTION OF GAME.

The year 1906 was notable in the concerted efforts made by game protective associations and other organizations. New State associations were formed in Alabama, Idaho, Texas, and West Virginia. In January the National Association of State Commissioners and Wardens held a meeting at St. Paul, Minn., at which official representatives from 14 States were present. This meeting gave opportunity for conference and interchange of views, and proved an important factor toward securing greater uniformity of action on the part of State officials. The widespread interest in bird protection was strongly exemplified by a bequest made to the National Association of Audubon Societies which became available during the year through the death of Albert D. Wilcox. Mr. Wilcox had become deeply interested in the work of bird protection and left the association a specific bequest of $100,000, at the same time giving it one-half of a much larger residuary legacy. The total amount of the bequest to the association was $322,770, the income of which is to be devoted to educational work, promotion of legislation for the protection of birds and game, maintenance of warden service, and cooperation with State officials and local organizations in efforts to secure better enforcement of laws.

HUNTING ACCIDENTS.

The number of persons killed each year in hunting accidents is apparently increasing, and the unnecessary loss of life from this cause in 1906 was appalling. An effort was made by the Department to collect reports of such fatal accidents for the purpose

of ascertaining not only the number and the causes, but also the possibility of devising a method of reducing the number of similar accidents in the future. The reports showed that more than 100 persons lost their lives during the year, and of these at least eight were women and a dozen or more children under 15 years of age. These accidents occurred in 25 States and the District of Columbia, but were most frequent in Michigan and Wisconsin. Contrary to expectation, comparatively few were caused by persons being mistaken for deer or other big game. Several were caused by .22-caliber rifles and a number of others by ordinary shotguns.

Many of the accidents were due simply to gross carelessness in the use of firearms such as pulling a gun out of the boat by the muzzle, or looking down the barrel of a loaded weapon; others to handling of firearms by boys who had not been taught or who failed to observe the most elementary precautions. In a few instances these accidents were attributable directly to violation of the game laws. It is worthy of note that in States which prohibit the killing of does, or of deer with horns less than 3 inches in length, accidents were comparatively few, while in Michigan and Wisconsin, where there are no restrictions of this kind, more than the usual number of accidents occurred. It seems, therefore, that certain classes of accidents may be reached by legislation requiring a hunter to pause long enough to make sure that an object moving in the undergrowth is a deer with horns of sufficient length to come within the law. This delay is oftentimes sufficient to prevent the fatal mistake of wounding or killing a man for a deer. Legislation providing severe penalties for shooting persons by mistake has not thus far accomplished the desired object. Although such laws have been on the statute books of Maine, Michigan, and Minnesota for several years, apparently no conviction has thus far been obtained. Action was begun in at least one case in each State this year, but these cases are apparently still pending. The experience of the year seems to indicate that restrictions on the use of the .22 caliber rifle and the more general adoption of measures prohibiting killing deer with horns below a certain limit promise better results in preventing accidents than in declaring such accidents homicide, punishable by severe penalties.

CONDITION OF GAME.

Big game.—Statistics of the number of big game annually killed are now obtainable from several States, and form a fairly satisfactory basis for estimating increase or decrease from year to year. In Maine the number of moose shipped through Bangor was 185, a slight falling off from the record of 216 in 1905. The deer shipments, however, showed a decrease of about 20 per cent, 3,572, as compared with 4,791 during the previous year. In Vermont the commissioner reported that 634 deer were killed, an increase of about 125 over the number shot in 1905. In New York about 60 deer were killed on Long Island during the four days of open season, and in the Adirondacks, notwithstanding the fact that the season was shortened a month, the number of deer carried by the transportation companies increased about 200. These shipments comprised 2,413 carcasses, 108 saddles, and 102 heads, as compared with 2,196 carcasses, 108 saddles, and 180 heads transported in 1905. In Pennsylvania the number of deer killed was estimated at 600 to 650. In Michigan estimates placed the number captured at 12,000. In Wisconsin, Minnesota, and Texas deer were reported plentiful. In Wyoming the State warden estimated the number of head of big game killed at 4,798. Detailed reports showed that about 20 per cent of this number (1,011) comprised 598 elk, 182 deer, 184 antelope, and 47 mountain sheep. Reports from two of the Canadian Provinces indicated that 99 deer were killed under license in Manitoba, and the total number killed in Ontario approximated 10,000.

Quail.—Quail suffered less during the winter than in previous years, but several States found it necessary to increase their supply by importing birds from the South and West. Most of these birds seem to have done well, and in many sections quail were reported in normal abundance.

Grouse and woodcock.—Ruffed grouse were reported plentiful in New England (except Vermont) and in New York, New Jersey, Pennsylvania, Virginia, North Carolina, Michigan, Wisconsin, and Minnesota. Prairie chickens continued to increase in Illinois and Nebraska, but in other parts of their range seemed to be decreasing. In the Rocky Mountain region, particularly in Montana, Utah, and Idaho, the grouse seemed to have suffered from the wet spring. In Wyoming and Colorado, however, sage hens were reported plentiful. Woodcock were fairly common in Vermont, Connecticut, and New York, but comparatively scarce in Pennsylvania and the Middle West.

Wild fowl.—The fall flight of ducks proved a disappointment in nearly all parts of the country, and the number of birds seemed to be much less than in either 1904 or 1905. Only a few places reported ducks in their usual abundance. In some instances,

no doubt, the apparent decrease was due to unfavorable weather conditions, which caused the birds to hasten on their way south without stopping as long as usual, but whether the flight of 1906 was actually or apparently much smaller than those of the two previous years can only be determined by future observations.

GAME FOR PROPAGATION.

Restocking with both big game and certain game birds attracted much attention in several of the Eastern States. The restocking of the Adirondacks with elk, which began in 1901, chiefly by private efforts, has now progressed beyond the experimental stage. A number of animals were liberated during the year and the total number of elk is now estimated at more than 300. The effort to reestablish beaver also progressed satisfactorily. Under the appropriation of $1,000 made by the legislature several were obtained and arrangements were made to secure additional animals from the Yellowstone National Park. The total number in the State park now exceeds 40. The experiments with moose have not been so successful, but an appropriation of $2,150 was made to continue the work in the hope of ultimately establishing the species in its former haunts. In New Jersey the deer liberated in former years have increased steadily, and are now found in at least one-half the counties of the State. Only 8 additional animals were liberated during the year. In addition to the deer 60 rabbits and 50 Canadian hares were distributed in various parts of the State. In Pennsylvania 30 female deer were purchased by the game commission for stocking the State game preserve. The State warden of Tennessee, through private subscription, purchased a herd of about 400 deer belonging to the Belle Meade Farm and liberated them in the vicinity of Nashville. Under the provision of the State law affording complete protection for two years, it is hoped that these deer may be able to establish themselves and form a nucleus for restocking other sections of the State.

Owing to the severity of previous winters, quail were in great demand for restocking depleted covers, particularly in Massachusetts, New Jersey, Pennsylvania, Maryland, Indiana, and Illinois. The demand was greatly in excess of the supply, and several of the States failed to secure birds in adequate numbers. The Massachusetts Fish and Game Protective Association, however, liberated 4,416; the fish and game commission of New Jersey 7,208, the game commission of Pennsylvania about 3,700, and the game commissioner of Illinois secured several thousand. Most of these birds were trapped in Alabama and the Southwest, and the manner of their capture caused much criticism by residents in the States where the trapping was done, and some complaints on the part of consignees. More than 60,000 birds were shipped from a few points in Alabama, where the birds were trapped in such wholesale numbers as to deplete the local stock, and were shipped without the attention to details necessary to insure their safe arrival. In consequence an undue proportion of the birds perished in transit or died soon after arrival. In Texas the wholesale trapping led to several arrests and the imprisonment for several weeks of three of the principal trappers. Attempts to secure a supply of birds from Mexico met with indifferent success. The important experiment inaugurated by the game commissioner of Illinois in 1905 of establishing a State game propagating farm made substantial progress. One hundred and sixty acres of land have been leased 23 miles south of Springfield, Ill., where pheasants, quail, and other birds are raised in large numbers for distribution in the State. In July, 1906, the commissioner reported that 3,000 healthy pheasant chicks had been hatched from a consignment of 5,500 eggs imported from England, and there were then on the farm about 8,000 young English and ring-necked pheasants besides a number of blue quail, a few wild turkeys, and prairie chickens.

Experiments in rearing quail in captivity were made by a number of individuals. In some cases, particularly in Kansas and Oregon, a number of birds were reared, but elsewhere failures were frequent. The American Breeders' Association appointed a special committee on breeding wild birds for the purpose of coordinating the efforts now being made by individuals and State authorities to encourage the propagation of game birds. This same line of work received recognition from the Carnegie Institution, of Washington, which made a grant of $500 to Prof. C. F. Hodge, of Clark University, Massachusetts, to enable him to continue his experiments in propagating ruffed grouse and other game birds in captivity.

IMPORTATIONS OF LIVE ANIMALS AND BIRDS.

During the calendar year 489 mammals, 381,324 birds, and 5,604 eggs of game birds were imported into the United States under permit. Among the mammals were 3 beaver and 234 squirrels; and of the birds 326,990 were canaries, 9,774 game birds, and 44,560 miscellaneous species. In comparison with the importations of 1905 these

figures show a decrease of about 800 mammals and increases of about 65,000 birds and 3,274 eggs. Among the game birds were 3,772 pheasants, 2,644 partridges, 113 capercailzie, 122 black game, 28 willow grouse, 19 hazel grouse, 2,359 quail, 340 ducks, and 377 miscellaneous birds. Among the rarer game birds were 4 Manchurian, 4 black-backed kalege, 3 Setchuan, 3 Mongolian, and 12 Prince of Wales pheasants, 4 brush turkeys, and 4 rufous tinamous. The Mongolian and Prince of Wales pheasants comprised the second importation of these species ever brought to the United States. Among the rarer miscellaneous birds worthy of mention were 4 keas, 6 weka rails, and 4 kiwis from New Zealand, 6 black-footed penguins, and 49 shama thrushes. The opening of the new bird house of the New York Zoological Society was occasion for the importation of a large number of European birds and a number of rare species from other parts of the world.

The most notable features of the importations of game birds were the unusually large number of European partridges brought over in the attempt to introduce the species in several localities, the importation of 5,500 eggs of pheasants by the State game commissioner of Illinois for propagation on the State farm near Springfield, and the continued imports of capercailzie and black game. In the consignment of pheasant eggs only 18 were broken in transit and unpacking, 1,809 proved unfertile, and over 3,000 healthy chicks were hatched, Capercailzie and black game have been imported in steadily increasing numbers during the past four years. In 1903, 65 capercailzie were imported for the Algonquin Park in Ontario; in 1904 about 100 capercailzie and 25 black game were liberated on the preserve of the Cleveland Cliffs Iron Company, on Grand Island, Mich.; and in 1905, 117 capercailzie and 74 black game were imported, many of them intended for the same preserve. In 1906, the total number of the two species imported increased to 235, and these birds were consigned chiefly to preserves in the Adirondacks. In addition to the birds brought to the United States, 22 capercailzie and 35 black game, imported direct from Copenhagen to British Columbia, were liberated at various points in that province. Seventy-six birds were purchased in Copenhagen and 74 reached Vancouver safely in October, but 17 died from the effects of the long journey. Of the 57 surviving the trip, 22 were capercailzie and 35 were black game. Of these, 19 black game were liberated on Vancouver Island, 16 black game near Nicomen, on the Fraser River, and 8 capercailzie on the North Arm of Burrard Inlet, 14 miles from Vancouver. The total cost of the experiment was $1,695. The black game have apparently not done as well as the capercailzie, but it is hoped that the latter species at least will ultimately become acclimated.

So far as known, no injurious species were introduced into the United States, but the English sparrow, still extending its range in the Southwest, was reported for the first time from Southern California at Newhall, in Los Angeles County.[a]

PRIVATE AND STATE PRESERVES.

The private preserve promises to become the most satisfactory means of providing good hunting and at the same time one of the most effective means of preserving and increasing the supply of game in the region in which it is situated. Private preserves owned or leased by individuals or associations continue to be established wherever conditions are favorable and suitable land can be obtained. Statistics of the individual preserves created in 1906 are incomplete, but reports show that such preserves were established in at least 20 different States.

In North Carolina the Audobon Society purchased Royal Shoal Islands and the islands known as the Legged Lump, in Pamlico Sound, as a refuge and breeding ground for gulls and terns.

In Pennsylvania definite and satisfactory progress was made in the creation of State game preserves under the provisions of the act of 1905. Three parks, each containing from 3,000 to 4,000 acres, were located in the forest reserves in Clearfield, Clinton, and Franklin counties. Each park is to be surrounded by a fire line or path 8 to 10 feet in width, and along this path a single wire is stretched from tree to tree, on which are fastened notices calling attention to the purposes of the inclosure and prohibiting trespass within its limits for any purpose. The work on the preserves in Clearfield and Clinton counties was completed, and the corners of the preserve in Franklin County were located and the cutting of the fire line begun.

Reference should be made also to two provincial game preserves established in Canada. One of these, comprising 16 sections, was set apart in Alberta, about 30 miles northeast of Edmonton; the other, known as the Gaspesian Preserve, was established by the Province of Quebec, on the Gaspé Peninsula. The latter preserve comprises about 2,500 square miles, and is comparable with the largest preserves on the

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[a] Condor, IX, p. 28, 1907.

continent, such as the Laurentides National Park in Quebec, the Algonquin Park in Ontario, the Canadian National Park in Alberta, and the Yellowstone National Park.

NATIONAL PARKS, REFUGES, AND RESERVATIONS.

More progress was made in the establishment of refuges for birds and game than during any previous year. By Executive order dated February 10, 1906, Indian Key, an island of 90 acres at the mouth of Tampa Bay, Florida, was set aside under the charge of the Department of Agriculture as a preserve and breeding ground for native birds. An item of $15,000 included in the agricultural bill provided for erecting a fence for a buffalo inclosure on the Wichita Game Reserve in Oklahoma. The contract has been let, and the work of constructing the fence is now in progress. Congress authorized the lease of a tract of not more than 3,500 acres of public land in Stanley County, near Pierre, S. Dak., for the benefit of the Phillips herd of buffalo, and on June 29 authorized the establishment of a second game refuge in the Grand Canyon National Forest, in northern Arizona. This game refuge, as created by proclamation of November 28, comprises 2,267,300 acres. In this connection may also be mentioned the act of June 30 prohibiting upland hunting in the District of Columbia, which practically renders the District a game and bird refuge.

Reports from all of the preserves previously established showed satisfactory progress. The results were especially noteworthy on the Pelican Island Reservation, in Florida, and on the Breton Island Reservation, off the mouth of the Mississippi River. On Pelican Island nesting began unusually early, 600 nests having been constructed by November 18, 1905, and many young hatched before the close of the year. In February, during a period of cold and inclement weather, 600 or 700 of the young birds perished, but about 150 young survived. On April 15 the old birds again began to nest, and succeeded in raising about 400 young, so that the total number of birds reared on the island exceeded that of any previous year since the reservation was established. The Breton Island Reservation comprises some 8 islands, and near by, along the Louisiana coast, are 17 islands included in the Audubon Reservation, the latter controlled and maintained by the State Audubon Society of Louisiana. These two reservations together make up one of the greatest sea-bird breeding areas in the world. Here an immense number of laughing gulls, Forster terns, black skimmers, and royal terns were raised, estimated at 100,000 in all. The severe hurricane which passed over the reservations in September killed some of the birds, and materially changed the conditions on certain of the islands. Grand Cochère, one of the best breeding grounds, was reported submerged and waves broke over Breton Island, carrying away the house of refuge, but at the same time causing the destruction of the raccoons and other animals which infested the island and interfered with the nesting of the birds.

In the Yellowstone National Park, as shown by the report of the superintendent, the buffalo herd has steadily increased from the 2 bulls and 18 cows purchased in 1902 until it now numbers 57. Arrangements were completed during the summer for moving all the young buffalo of this herd to the mouth of the Lamar River, at the mouth of Rose Creek, where hay will be raised and the animals gradually turned loose under conditions where they can readily obtain feed at all times. The old buffalo will be kept as heretofore at Mammoth Hot Springs, and this division of the herd will act as a safeguard against the spread of disease which might break out in either band. About 1,500 antelope came down to the feeding grounds near the haystacks in the vicinity of Gardiner, and at the same point 1,200 elk were seen and counted one evening during the latter part of the winter. In spite of the heavy fall of snow, the percentage of loss of big game was very small, and the animals came through the season in good condition.

FARMERS' INSTITUTES.

Farmers' institutes were held during the year ended June 30, 1906, in all of the States and Territories excepting Alaska, Florida, Nevada, New Mexico, and Washington. The following table gives a summary of the work for the year:

Statistics of farmers' institutes for season ended June 30, 1906.

State or Territory.	Meetings. Total number.	Meetings. One day.	Meetings. Two days or more.	Meetings. Number of sessions.	Total attendance.	Speakers on State force.	Funds for institutes. Appropriated for year ended June 30, 1906.	Funds for institutes. Appropriated for year ended June 30, 1907.	Report of proceedings. Published.	Report of proceedings. Number of copies.
Alabama	35	27	8	85	8,590	13	$600.00	$600.00	No	....
Arizona	21	21	......	21	1,307	3	608.85	....	No	....
Arkansas	31	28	3	42	7,150	6	400.00	....	No	....
California	83	55	28	272	22,861	37	9,000.00	6,000.00	Yes	12,500
Colorado	40	24	16	123	16,675	23	4,000.00	....	Yes	10,000
Connecticut	24	24	......	83	4,895	60	1,825.00	....	No	....
Delaware	18	18	......	40	7,200	11	725.00	600.00	Yes	5,000
Georgia	21	17	4	42	4,500	34	2,500.00	2,500.00	No	....
Hawaii	4	4	8	8	300	9	33.45	....	Yes	1,000
Idaho	21	5	16	105	7,875	13	1,000.00	1,000.00	No	....
Illinois	108	......	108	667	79,428	109	30,281.55	17,150.00	Yes	20,000
Indiana	250	118	132	918	129,894	46	12,500.00	10,000.00	No	....
Iowa	69	......	69	402	66,959	5	8,096.06	7,425.00	....	....
Kansas	155	128	27	522	27,300	21	2,000.00	2,500.00	No	....
Kentucky	25	1	24	122	....	......	1,750.00	15,000.00	....	....
Louisiana	22	22	......	44	2,657	20	2,000.00	2,000.00	Yes	2,500
Maine	50	50	......	102	6,967	27	5,000.00	5,000.00	....	....
Maryland	49	37	12	125	10,762	8	6,000.00	6,000.00	....	....
Massachusetts	125	125	......	153	19,125	69	3,000.00	3,000.00	Yes	15,000
Michigan	335	259	76	934	122,573	42	15,000.00	7,500.00	Yes	9,500
Minnesota	105	98	7	238	51,211	105	20,238.40	18,000.00	Yes	35,000
Mississippi	110	108	2	220	10,000	21	3,000.00	3,000.00	No	....
Missouri[a]	......	......	......	......	....	......	....	....	....	....
Montana	71	64	7	133	7,890	25	5,000.00	4,000.00	Yes	5,000
Nebraska	160	71	89	515	72,894	38	8,607.00	6,000.00	No	....
New Hampshire	16	15	1	34	3,000	12	2,100.00	1,600.00	Yes	2,000
New Jersey	40	33	7	116	11,611	14	3,000.00	3,000.00	No	....
New York	259	114	145	1,062	134,989	64	20,000.00	20,000.00	Yes	15,000
North Carolina	96	95	1	195	25,950	21	5,500.00	3,500.00	Yes	30,000
North Dakota	43	17	26	162	20,310	47	6,379.07	6,000.00	Yes	10,000
Ohio	245	......	245	1,225	81,816	27	17,629.89	22,000.00	Yes	15,000
Oklahoma	31	2	29	149	7,460	9	660.00	....	No	....
Oregon	44	40	4	109	16,350	8	2,500.00	2,500.00	No	....
Pennsylvania	226	63	163	987	165,553	56	20,500.00	20,500.00	Yes	50,000
Porto Rico	1	1	......	1	50	3	....	....	No	....
Rhode Island	1	......	1	2	300	4	100.00	....	Yes	2,000
South Carolina	54	54	......	74	11,149	15	4,524.40	5,000.00	No	....
South Dakota	59	17	42	119	10,000	14	6,500.00	5,000.00	Yes	600
Tennessee	35	5	30	68	6,000	11	2,500.00	2,500.00	Yes	5,000
Texas	27	25	2	35	4,500	39	540.00	....	No	....
Utah	45	40	5	73	6,680	17	2,000.00	1,500.00	Yes	7,000
Vermont	38	38	......	76	7,962	26	5,000.00	....	Yes	3,000
Virginia	......	......	......	65	19,500	11	5,000.00	5,000.00	No	....
West Virginia	81	50	31	224	4,480	29	3,966.12	4,000.00	Yes	....
Wisconsin	81	81	......	243	32,200	24	2,000.00	12,000.00	Yes	60,000
Wyoming	11	4	7	64	3,401	1	1,107.59	1,000.00	No	....
Total	3,365	1,998	1,367	10,999	1,262,272	1,197	264,672.38	232,375.00	....	315,100

[a] No report received.

STATISTICS OF THE PRINCIPAL CROPS.

[Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise credited. All prices on gold basis.]

CORN.

Corn crop of countries named, 1901–1905.

[Substantially the crop of the world.]

Country.	1901.	1902.	1903.	1904.	1905.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	1,522,520,000	2,523,648,000	2,244,177,000	2,467,481,000	2,707,994,000
Canada (Ontario)	28,021,000	21,159,000	25,211,000	20,888,000	21,582,000
Mexico	91,474,000	78,000,000	90,579,000	88,101,000	89,000,000
Total North America	1,641,970,000	2,622,996,000	2,359,967,000	2,576,470,000	2,818,576,000
SOUTH AMERICA.					
Argentina	98,542,000	84,018,000	148,948,000	175,188,000	140,708,000
Chile	1,501,000	868,000	1,118,000	1,477,000	1,000,000
Uruguay	5,878,000	5,000,000	5,289,000	3,015,000	4,417,000
Total South America	105,926,000	89,944,000	155,355,000	179,701,000	146,125,000
EUROPE.					
Austria-Hungary:					
Austria	17,585,000	11,462,000	16,056,000	12,529,000	17,299,000
Hungary proper	127,285,000	104,541,000	135,750,000	59,400,000	94,042,000
Croatia-Slavonia	25,406,000	15,255,000	23,779,000	11,364,000	18,385,000
Bosnia-Herzegovina	5,800,000	5,865,000	8,411,000	6,464,000	9,584,000
Total Austria-Hungary	175,190,000	139,126,000	183,994,000	89,757,000	139,304,000
Bulgaria	25,000,000	18,300,000	22,536,000	12,758,000	19,649,000
France	25,797,000	24,928,000	25,390,000	19,452,000	24,016,000
Italy	121,431,000	71,928,000	88,280,000	90,640,000	97,857,000
Portugal	15,000,000	16,000,000	14,000,000	15,000,000	16,000,000
Roumania	110,645,000	65,447,000	86,272,000	19,598,000	59,275,000
Russia:					
Russia proper	60,771,000	40,377,000	40,397,000	18,950,000	22,507,000
Poland	....	....	....	[illegible]	....
Northern Caucasia[a]	7,623,000	8,270,000	10,335,000	7,062,000	11,018,000
Total Russia (European)	68,394,000	48,647,000	50,732,000	26,072,000	33,551,000
Servia	18,848,000	18,296,000	16,479,000	9,488,000	21,471,000
Spain	25,758,000	25,272,000	18,759,000	21,380,000	21,840,000
Total Europe	571,988,000	422,655,000	504,422,000	307,065,000	442,000,000
AFRICA.					
Algeria	528,000	558,000	451,000	311,000	400,000
Anglo-Egyptian Sudan	204,000	200,000	184,000	188,000	232,000
Cape of Good Hope	2,000,000	2,000,000	3,501,000	3,000,000	3,000,000
Egypt	30,000,000	30,000,000	31,000,000	30,000,000	30,000,000
Natal	4,478,000	4,151,000	1,987,000	5,282,000	4,822,000
Total Africa	37,208,000	36,909,000	37,118,000	38,802,000	38,454,000
AUSTRALASIA.					
Australian Commonwealth	8,650,000	7,256,000	4,988,000	9,972,000	8,174,000
New Zealand	510,000	590,000	627,000	547,000	590,000
Total Australasia	9,160,000	7,846,000	5,615,000	10,519,000	8,764,000
Grand total	2,366,292,000	3,180,350,000	3,066,777,000	3,112,634,000	3,453,904,000

a Includes government of Chernomorsk.

Acreage, production, value, prices, and exports of corn of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including corn meal, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1866	34,306,538	25.3	867,946,295	47.4	411,450,830	53	62	64	79	16,026,947
1867	32,520,249	23.6	768,320,000	57.0	437,769,763	61	65	61	71	12,493,522
1868	34,887,246	26.0	906,527,000	46.8	424,056,649	38	58	44	51	8,286,665
1869	37,103,245	23.6	874,320,000	59.8	522,550,509	56	67	73	85	2,140,487
1870	38,646,977	28.3	1,094,255,000	49.4	540,520,456	41	59	46	52	10,676,873
1871	34,091,137	29.1	991,898,000	43.4	430,355,910	36	39	38	43	35,727,010
1872	35,526,836	30.8	1,092,719,000	35.3	385,736,210	27	28	34	39	40,154,374
1873	39,197,148	23.8	932,274,000	44.2	411,961,151	40	49	49	59	35,985,834
1874	41,036,918	20.7	850,148,500	58.4	496,271,255	64	76	53	67	30,025,036
1875	44,841,371	29.5	1,321,069,000	36.7	484,674,804	40	47	41	45	50,910,532
1876	49,033,364	26.2	1,283,827,500	34.0	436,108,521	40	43	43	56	72,652,611
1877	50,369,113	26.7	1,342,558,000	34.8	467,635,230	41	49	35	41	87,192,110
1878	51,585,000	26.9	1,388,218,750	31.7	440,280,517	30	32	33	36	87,884,892
1879	53,085,450	29.2	1,547,901,790	37.5	580,486,217	39	43¼	32⅜	36⅛	99,572,329
1880	62,317,842	27.6	1,717,434,543	39.6	679,714,499	35⅝	42	41½	45	93,648,147
1881	64,262,025	18.6	1,194,916,000	63.6	759,482,170	58⅛	63½	69	76⅞	44,340,683
1882	65,659,545	24.6	1,617,025,100	48.5	783,867,175	49¼	61	53¼	56¾	41,655,653
1883	68,301,889	22.7	1,551,066,895	42.4	658,051,485	54¼	63½	52½	57	46,258,606
1884	69,683,780	25.8	1,795,528,432	35.7	640,735,559	34½	40¼	44¾	49	52,876,456
1885	73,130,150	26.5	1,936,176,000	32.8	635,674,630	36	42¼	34¼	36¾	64,829,617
1886	75,694,208	22.0	1,665,441,000	36.6	610,311,000	35¾	38	36⅞	39⅝	41,368,584
1887	72,392,720	20.1	1,456,161,000	44.4	646,106,770	47	51⅛	54	60	25,360,869
1888	75,672,763	26.3	1,987,790,000	34.1	677,561,580	33½	35⅛	33⅛	35⅜	70,841,673
1889	78,319,651	27.0	2,112,892,000	28.3	597,918,829	29¼	35	32¾	35	103,418,709
1890	71,970,763	20.7	1,489,970,000	50.6	754,433,451	47¾	53	55	69½	32,041,529
1891	76,204,515	27.0	2,060,154,000	40.6	836,439,228	39⅜	59	40¾	a100	76,602,285
1892	70,626,658	23.1	1,628,464,000	39.4	642,146,630	40	42⅞	39½	44½	47,121,894
1893	72,036,465	22.5	1,619,496,131	36.5	591,625,627	34¼	36½	36¾	38½	66,489,529
1894	62,582,269	19.4	1,212,770,052	45.7	554,719,162	44¾	47½	47¾	55½	28,585,405
1895	82,075,830	26.2	2,151,138,580	25.3	544,985,534	25	26¾	27½	29½	101,100,375
1896	81,027,156	28.2	2,283,875,165	21.5	491,006,967	22½	23¾	23	25½	178,817,417
1897	80,095,051	23.8	1,902,967,933	26.3	501,072,952	25	27½	32⅜	37	212,055,543
1898	77,721,781	24.8	1,924,184,660	28.7	552,023,428	33⅛	38	32½	34⅜	177,255,046
1899	82,108,587	25.3	2,078,143,933	30.3	629,210,110	30	31½	36	40½	213,123,412
1900	83,320,872	25.3	2,105,102,516	35.7	751,220,034	35¼	40½	42⅝	58½	181,405,473
1901	91,349,928	16.7	1,522,519,891	60.5	921,555,768	62½	67½	59⅛	64¾	28,028,688
1902	94,043,613	26.8	2,523,648,312	40.3	1,017,017,349	43¾	57¼	44	46	76,639,261
1903	88,091,993	25.5	2,244,176,925	42.5	952,868,801	41	43¾	47¼	50	58,222,061
1904	92,231,581	26.8	2,467,480,934	44.1	1,087,461,440	43½	49	48	64½	90,293,483
1905	94,011,369	28.8	2,707,993,540	41.2	1,116,696,738	42	50¼	47½	50	119,893,833
1906	96,737,581	30.3	2,927,416,091	39.9	1,166,626,479	40	46	......	......	......

a Coincident with "corner."

Visible supply of corn in the United States and Canada, first of each month for ten years.a

Month.	1897–98.	1898–99.	1899–1900.	1900–1901.	1901–2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	21,501,000	32,983,000	21,551,000	19,087,000	21,522,000
August	20,018,000	25,430,000	17,687,000	18,613,000	19,648,000
September	37,528,000	24,043,000	11,070,000	8,766,000	19,476,000
October	45,412,000	30,132,000	16,662,000	11,106,000	21,215,000
November	52,980,000	33,198,000	18,738,000	11,061,000	19,137,000
December	49,559,000	25,870,000	17,555,000	12,791,000	16,592,000
January	48,292,000	26,936,000	19,024,000	14,313,000	16,825,000
February	53,522,000	36,726,000	20,110,000	21,950,000	17,197,000
March	52,457,000	44,792,000	28,340,000	27,538,000	15,270,000
April	52,228,000	43,618,000	31,883,000	28,947,000	13,540,000
May	34,734,000	34,236,000	30,416,000	24,544,000	9,093,000
June	28,288,000	19,070,000	18,289,000	21,904,000	6,317,000

a These figures represent stocks available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals, as reported by Bradstreet's.

Visible supply of corn in the United States and Canada, etc.—Continued.

Month.	1902-3.	1903-4.	1904-5.	1905-6.	1906-7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	8,541,000	13,410,000	12,362,000	9,571,000	12,917,000
August	9,013,000	11,715,000	10,673,000	10,101,000	9,655,000
September	3,823,000	9,487,000	8,614,000	8,080,000	4,760,000
October	4,607,000	15,068,000	10,703,000	8,796,000	7,843,000
November	4,229,000	12,147,000	5,119,000	5,183,000	6,492,000
December	4,552,000	9,817,000	5,445,000	10,236,000	5,133,000
January	9,345,000	9,547,000	15,551,000	17,830,000	8,404,000
February	11,535,000	12,867,000	19,721,000	22,010,000	14,097,000
March	15,180,000	16,669,000	16,752,000	24,531,000	18,085,000
April	16,901,000	16,571,000	16,124,000	17,653,000	20,827,000
May	9,454,000	13,253,000	14,661,000	7,674,000	17,011,000
June	7,039,000	7,572,000	8,374,000	7,366,000	....

Acreage, production, value, and distribution of corn in the United States in 1906, by States.

State or Territory.	Crop of 1906.			Stock in farmers' hands March 1, 1907.		Shipped out of county where grown.
	Acreage.	Production.	Value.			
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*Per cent.*	*Bushels.*
Maine	12,350	456,950	292,448	86,820	19	4,570
New Hampshire	26,234	983,775	629,616	245,944	25	0
Vermont	56,491	2,005,430	1,183,204	501,358	25	0
Massachusetts	44,799	1,778,520	1,067,112	515,771	29	0
Rhode Island	10,011	331,364	212,073	112,664	34	3,314
Connecticut	55,595	2,223,800	1,334,280	644,902	29	22,238
New York	650,000	22,685,000	13,384,150	7,939,750	35	453,700
New Jersey	277,749	10,082,289	5,343,613	4,234,561	42	1,512,343
Pennsylvania	1,441,797	57,960,239	30,139,324	26,082,108	45	4,057,217
Delaware	196,472	5,894,160	2,475,547	2,947,080	50	2,357,664
Maryland	628,795	22,007,825	9,903,521	10,343,678	47	6,162,191
Virginia	1,859,610	45,188,523	24,853,688	19,882,950	44	4,066,967
West Virginia	750,000	22,725,000	12,498,750	8,181,000	36	1,136,250
North Carolina	2,731,829	41,793,846	28,421,855	18,390,012	44	1,253,905
South Carolina	1,945,347	23,611,253	17,236,200	11,097,289	47	472,225
Georgia	4,338,883	52,066,596	34,884,619	24,471,300	47	1,561,998
Florida	625,000	6,875,000	4,262,500	2,543,750	37	68,750
Ohio	3,325,000	141,645,000	55,241,550	60,907,350	43	41,077,050
Indiana	4,644,782	183,863,767	66,201,756	80,916,257	44	62,523,881
Illinois	9,614,886	347,169,585	124,981,051	166,641,401	48	142,339,530
Michigan	1,475,000	54,575,000	24,013,000	21,830,000	40	3,274,500
Wisconsin	1,458,877	60,105,732	24,643,350	23,441,235	39	1,803,172
Minnesota	1,492,228	50,149,277	17,050,754	18,053,740	36	6,017,913
Iowa	9,450,000	373,275,000	119,448,000	182,904,750	49	97,051,500
Missouri	7,075,000	228,522,500	84,838,550	98,264,675	43	29,707,925
North Dakota	150,000	4,170,000	1,626,300	1,042,500	25	83,400
South Dakota	1,875,000	62,812,500	18,215,625	32,034,375	51	12,562,500
Nebraska	7,325,000	249,782,500	72,436,925	119,895,600	48	122,393,425
Kansas	6,750,000	195,075,000	62,424,000	76,079,250	39	56,571,750
Kentucky	3,105,072	105,437,376	44,283,698	47,446,819	45	12,652,485
Tennessee	3,075,762	86,428,912	40,621,589	39,757,300	46	12,964,337
Alabama	2,990,587	47,849,392	30,623,611	21,532,226	45	956,988
Mississippi	2,204,822	40,789,207	24,881,416	17,947,251	44	815,784
Louisiana	1,524,281	26,217,633	15,730,580	9,176,172	35	262,176
Texas	6,924,657	155,804,782	77,902,391	56,089,722	36	6,232,191
Indian Territory	2,038,490	68,493,264	21,917,844	29,452,104	43	23,972,642
Oklahoma	1,998,095	65,737,326	19,721,198	30,896,543	47	21,035,944
Arkansas	2,237,397	52,862,569	24,817,207	23,761,156	45	1,584,077
Montana	3,980	93,132	60,536	13,970	15	0
Wyoming	2,528	68,256	40,271	13,651	20	0
Colorado	113,159	3,157,136	1,578,568	757,713	24	189,428
New Mexico	40,211	1,182,203	851,186	295,551	25	59,110
Arizona	7,462	220,129	187,110	66,039	30	2,201
Utah	11,126	356,032	263,464	71,206	20	3,560
Idaho	5,231	148,037	82,901	29,607	20	0
Washington	11,444	288,389	158,614	43,258	15	8,652
Oregon	18,083	499,091	324,409	59,891	12	4,991
California	57,158	1,994,814	1,336,525	339,118	17	259,326
United States	96,737,581	2,927,416,091	1,166,626,479	1,297,978,958	44.3	679,543,770

Average yield per acre of corn in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	37.0	40.0	36.0	36.0	39.4	21.7	30.2	39.7	34.3	37.0
New Hampshire	34.0	41.0	39.0	37.0	38.5	23.3	21.0	27.3	37.0	37.5
Vermont	35.0	43.0	36.0	40.0	40.0	21.8	23.4	35.9	34.7	35.5
Massachusetts	32.5	40.0	36.0	38.0	40.5	31.3	24.0	36.0	37.5	39.7
Rhode Island	31.0	34.0	31.0	32.0	32.1	28.4	30.1	34.1	32.5	33.1
Connecticut	31.5	37.0	39.0	38.0	39.0	31.5	22.4	38.9	42.7	40.0
New York	31.0	33.0	31.0	32.0	33.0	25.0	25.0	27.3	31.5	34.9
New Jersey	31.5	37.0	39.0	33.0	36.9	34.5	24.0	38.0	35.8	36.3
Pennsylvania	36.0	37.0	32.0	25.0	35.0	36.1	31.2	34.0	38.9	40.2
Delaware	29.0	25.0	22.0	24.0	30.6	28.0	27.5	30.4	30.4	30.0
Maryland	33.0	31.0	32.0	26.0	34.2	32.4	28.7	33.4	36.9	35.0
Virginia	18.0	22.0	20.0	16.0	22.2	22.0	21.8	23.3	23.4	24.3
West Virginia	24.5	29.0	26.0	27.0	23.0	26.5	22.6	25.3	29.8	30.3
North Carolina	13.0	14.0	13.0	12.0	12.0	13.9	14.7	15.2	13.9	15.3
South Carolina	9.0	10.0	9.0	7.0	6.9	10.4	10.3	12.4	10.9	12.2
Georgia	11.0	9.0	10.0	10.0	10.0	9.0	11.7	11.9	11.0	12.0
Florida	8.0	9.0	10.0	8.0	9.0	8.6	9.9	10.7	10.1	11.0
Ohio	32.5	37.0	36.0	37.0	26.1	38.0	29.6	32.5	37.8	42.6
Indiana	30.0	36.0	38.0	38.0	19.8	37.9	33.2	31.5	40.7	39.6
Illinois	32.5	30.0	36.0	37.0	21.4	38.7	32.2	36.5	39.8	36.1
Michigan	31.5	34.0	25.0	36.0	34.5	26.4	33.5	28.6	34.0	37.0
Wisconsin	33.0	35.0	35.0	40.0	27.4	28.2	29.3	29.7	37.6	41.2
Minnesota	26.0	32.0	33.0	33.0	26.3	22.8	28.3	26.9	32.5	33.6
Iowa	29.0	35.0	31.0	38.0	25.0	32.0	28.0	32.6	34.8	39.5
Missouri	26.0	26.0	26.0	28.0	10.1	39.0	32.4	26.2	33.8	32.3
North Dakota	17.0	19.0	23.0	16.0	22.6	19.4	25.2	21.2	27.5	27.8
South Dakota	24.0	28.0	26.0	27.0	21.0	18.9	27.2	28.1	31.8	33.5
Nebraska	30.0	21.0	28.0	26.0	14.1	32.3	26.0	32.8	32.8	34.1
Kansas	18.0	16.0	27.0	19.0	7.8	29.9	25.6	20.9	27.7	28.9
Kentucky	23.0	31.0	21.0	26.0	15.6	27.0	26.6	26.9	29.7	33.0
Tennessee	21.0	26.0	20.0	20.0	14.2	21.9	23.5	25.0	24.6	28.1
Alabama	12.0	15.0	12.0	11.0	10.9	8.4	14.8	15.0	14.8	16.0
Mississippi	14.5	18.0	16.0	11.0	10.9	11.5	18.4	19.1	14.3	18.5
Louisiana	17.0	18.0	18.0	17.0	13.7	12.5	20.6	19.9	13.7	17.2
Texas	18.5	25.0	18.0	18.5	11.6	8.1	24.2	22.6	21.3	22.5
Indian Territory	......	......	......	......	12.0	24.9	27.7	32.4	32.7	33.6
Oklahoma	......	......	19.0	26.0	7.3	25.8	23.3	28.1	25.3	32.9
Arkansas	16.0	20.0	20.0	19.0	8.1	21.3	20.9	21.6	17.3	23.6
Montana	18.0	28.0	23.0	15.0	25.0	22.0	24.1	22.2	19.4	23.4
Wyoming	12.0	16.0	22.0	34.0	39.5	19.8	19.4	32.5	26.9	27.0
Colorado	19.0	18.0	17.0	19.0	17.1	16.5	19.8	20.5	23.8	27.9
New Mexico	27.0	21.0	20.0	22.0	31.6	22.0	24.0	22.7	25.3	29.4
Arizona	......	......	......	......	18.0	20.2	22.4	23.8	27.0	29.5
Utah	22.0	21.0	20.0	20.0	19.4	20.1	21.4	33.2	36.2	32.0
Idaho	......	......	......	......	23.0	24.7	34.5	29.3	27.2	28.3
Washington	18.0	12.0	23.0	20.0	17.5	23.0	23.1	24.7	24.2	25.2
Oregon	25.0	24.0	22.0	23.0	20.8	23.4	25.8	28.8	23.0	27.6
California	31.5	26.0	27.0	25.0	31.0	30.5	30.7	28.6	32.0	34.9
General average	23.8	24.8	25.3	25.3	16.7	26.8	25.5	26.8	28.8	30.3

Average value per acre of corn in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$17.39	$19.20	$18.00	$19.80	$29.94	$16.06	$19.93	$32.16	$23.67	$23.68
New Hampshire	15.30	18.86	19.11	20.72	30.03	17.01	13.23	19.66	25.53	24.00
Vermont	15.05	18.92	16.92	20.00	29.20	14.82	14.51	26.21	23.60	20.95
Massachusetts	15.28	19.60	18.36	20.52	30.78	23.16	15.84	25.92	26.25	23.82
Rhode Island	16.74	21.76	16.43	21.44	24.40	22.15	24.38	28.64	23.08	21.18
Connecticut	15.43	19.24	19.50	20.90	29.25	23.31	15.01	28.40	30.32	24.00
New York	12.40	14.19	13.95	15.04	23.76	16.75	15.00	17.47	19.21	20.59
New Jersey	11.97	14.80	15.60	14.85	24.35	19.32	13.68	22.04	19.69	19.24
Pennsylvania	22.24	14.80	13.12	11.25	21.70	20.94	17.78	20.06	21.01	20.90
Delaware	8.70	7.75	7.48	9.12	17.10	13.72	13.48	14.90	14.29	12.60
Maryland	9.90	10.85	11.52	10.66	19.84	16.52	14.64	16.70	17.71	15.75
Virginia	6.84	7.70	7.60	7.84	13.10	11.44	11.55	13.75	12.40	13.37
West Virginia	9.80	10.73	11.70	13.50	14.95	14.31	14.46	16.19	15.79	16.66
North Carolina	5.59	6.02	6.11	6.84	8.76	8.34	8.97	9.42	8.90	10.40
South Carolina	4.41	4.60	4.50	4.48	5.80	7.18	7.11	8.68	8.07	8.91
Georgia	5.28	4.32	5.00	5.70	8.20	6.57	8.07	8.45	7.70	8.04
Florida	4.40	4.50	5.30	4.80	7.65	6.62	7.23	8.02	6.67	6.82
Ohio	8.12	9.99	10.80	12.58	14.88	15.96	13.91	14.95	16.25	16.61
Indiana	6.30	9.00	10.26	12.16	10.89	13.64	11.95	12.91	15.47	14.26
Illinois	6.83	7.50	9.36	11.84	12.20	13.93	11.59	14.23	15.12	13.00

Average value per acre of corn in the United States, based upon farm value December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Michigan	$8.51	$11.36	$[illegible]	$[illegible]	$17.[illegible]	$13.73	$15.41	$14.87	$15.64	$16.28
Wisconsin	8.25	9.80	10.[illegible]	[illegible]	14.[illegible]	14.10	12.00	13.06	15.79	16.89
Minnesota	6.14	7.[illegible]	7.92	9.57	11.82	9.12	10.75	9.68	10.72	11.42
Iowa	4.[illegible]	[illegible]	7.13	[illegible]	[illegible]	[illegible]	[illegible]	10.76	11.83	12.64
Missouri	6.14	7.02	7.80	[illegible]	6.77	12.87	11.02	11.59	12.51	12.27
North Dakota	5.44	6.84	7.54	6.72	[illegible]	8.73	10.58	8.48	9.90	10.84
South Dakota	5.04	6.44	6.7[illegible]	7.85	9.45	7.75	9.52	10.12	9.86	9.72
Nebraska	5.10	4.62	6.44	8.06	7.[illegible]	9.69	7.28	10.82	10.50	9.89
Kansas	3.[illegible]	4.16	6.73	6.08	4.41	10.17	9.22	8.57	9.14	9.25
Kentucky	8.65	8.37	7.77	10.48	9.42	11.34	14.95	13.18	12.77	13.86
Tennessee	7.56	7.54	7.80	9.80	9.25	10.28	11.52	12.50	12.30	13.21
Alabama	5.22	6.15	5.64	6.78	8.[illegible]	5.65	8.44	9.00	9.47	10.24
Mississippi	6.73	7.02	7.[illegible]	6.58	8.05	7.02	6.64	10.70	9.30	11.28
Louisiana	7.65	7.98	7.92	8.30	10.37	8.25	11.35	11.34	8.36	10.32
Texas	7.28	8.30	6.48	8.45	9.28	5.85	11.02	11.75	10.44	11.25
Indian Territory					9.12	10.71	10.80	12.[illegible]	12.10	10.75
Oklahoma			5.80	6.78	5.55	10.06	8.85	10.[illegible]	8.10	9.87
Arkansas	6.4[illegible]	5.8[illegible]	7.[illegible]	8.17	6.50	10.44	10.[illegible]	11.45	9.51	11.09
Montana	11.7[illegible]	18.48	11.[illegible]	8.85	21.30	15.84	14.34	15.16	13.19	15.21
Wyoming	8.10	8.80	9.[illegible]	24.5[illegible]	28.44	11.88	11.35	18.52	20.17	15.93
Colorado	7.22	7.20	7.41	9.12	12.[illegible]	9.75	10.60	11.07	11.19	15.95
New Mexico	15.06	11.78	11.00	14.08	14.[illegible]	17.10	18.00	17.71	17.46	21.17
Arizona					16.2[illegible]	20.40	20.1[illegible]	21.66	20.19	25.08
Utah	12.14	12.00	11.80	12.00	17.4[illegible]	13.47	14.98	20.90	25.54	23.68
Idaho					13.90	16.71	19.67	29.51	17.95	15.85
Washington	9.00	5.04	11.[illegible]	11.80	10.10	14.85	12.70	10.80	14.52	15.80
Oregon	11.35	14.40	14.88	10.11	11.80	15.44	17.19	17.57	16.57	17.94
California	17.84	16.12	16.20	15.25	21.08	20.49	22.72	22.31	24.32	25.38
General average	6.29	7.10	7.08	9.02	10.90	10.81	10.82	11.79	11.88	12.06

International trade in corn, including corn meal, 1901–1906.

GENERAL NOTE.—Substantially the international trade of the world. It should not be expected that the world's export and import totals for any year will agree. Among sources of disagreement are these: (1) Different periods of time covered in the "year" of the various countries; (2) imports received in year subsequent to year of export; (3) want of uniformity in classification of goods among countries; (4) different practices and varying degrees of failure in recording countries of origin and ultimate destination; (5) different practices of recording reexported goods; (6) opposite methods of treating free ports; (7) clerical errors, which, it may be assumed, are not infrequent.

The exports given are domestic exports, and the imports given are imports for consumption, as far as it is feasible and consistent so to express the facts. While there are some inevitable omissions from such a table as this, on the other hand there are some duplications because of reshipments that do not appear as such in official reports.

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	[illegible]	[illegible]	82,845,215	97,221,783	87,487,629
Austria-Hungary	Jan. 1	[illegible]	[illegible]	[illegible]	174,142	[illegible]
Belgium	Jan. 1	4,657,102	[illegible]	[illegible]	6,257,088	[illegible]
Bulgaria	Jan. 1	[illegible]	[illegible]	5,089,114	2,762,657	[illegible]
Netherlands	Jan. 1	[illegible]	[illegible]	[illegible]	4,442,002	4,278,[illegible]
Roumania	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	1,441,437
Russia	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	a 7,371,525
Servia	Jan. 1	[illegible]	[illegible]	171,767	136,225	[illegible] 115
United States	July 1	[illegible]	[illegible]	58,222,061	90,293,482	119,893,833
Uruguay	July 1	[illegible]	[illegible]	[illegible]	[illegible]	b 1,159,7[illegible]
Other countries		1,921,000	1,528,000	1,088,000	1,009,000	1,235,000
Total		[illegible]	214,056,827	217,112,454	248,006,457	235,685,213

a Preliminary figures. b Average, 1901–1904.

International trade in corn, including corn meal, 1901–1906—Continued.

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Austria-Hungary	Jan. 1	8,647,130	5,874,971	11,130,274	14,090,377	18,511,369
Belgium	Jan. 1	14,954,812	14,583,008	20,323,863	19,474,330	24,169,780
Cape of Good Hope	Jan. 1	2,833,220	1,943,896	3,471,281	1,236,927	2,171,601
Cuba	Jan. 1	1,486,138	1,150,176	619,326	696,517	[a] 988,039
Denmark	Jan. 1	11,988,644	12,355,050	8,772,022	9,284,777	10,859,257
Egypt	Jan. 1	426,907	55,266	142,537	53,017	1,279,749
France	Jan. 1	11,611,509	8,674,931	11,347,114	10,124,353	11,121,806
Germany [b]	Jan. 1	46,978,877	35,454,243	37,527,343	30,450,853	36,538,366
Italy	Jan. 1	9,985,324	8,216,902	15,092,527	8,365,123	5,904,844
Mexico	Jan. 1	963,047	142,102	496,028	[c] 476,182	[c] 1,454,327
Netherlands	Jan. 1	18,635,890	15,817,237	20,160,078	16,547,198	16,234,785
Norway	Jan. 1	743,642	637,387	765,246	555,991	541,949
Portugal	Jan. 1	424,416	759,967	366,605	531,889	2,607,130
Russia	Jan. 1	351,786	135,822	457,715	625,526	161,218
Spain	Jan. 1	2,637,703	993,272	1,484,490	2,761,426	1,904,186
Sweden	Jan. 1	585,747	191,958	189,357	234,986	491,035
Switzerland	Jan. 1	2,130,011	2,404,644	2,611,202	2,704,457	2,498,380
Transvaal	Jan. 1	[d] 1,642,166	1,306,038	2,197,476	1,422,985	[d] 1,642,166
United Kingdom	Jan. 1	105,819,438	89,371,445	101,284,919	86,076,697	84,156,490
Other countries		6,939,000	10,415,000	18,652,000	15,313,000	17,852,000
Total		249,785,407	210,483,315	257,091,403	221,026,611	241,088,477

[a] Average, 1901-1904. [b] Not including free ports. [c] Preliminary figures. [d] Average, 1902-1904.

Average farm price of corn per bushel in the United States, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	47	48	50	55	76	74	66	81	69	64
New Hampshire	45	46	49	56	78	73	63	72	69	64
Vermont	43	44	47	50	73	68	62	73	68	59
Massachusetts	47	49	51	54	76	74	66	72	70	60
Rhode Island	54	64	53	67	76	78	81	84	71	64
Connecticut	49	52	50	55	75	74	67	73	71	60
New York	40	43	45	47	72	67	60	64	61	59
New Jersey	38	40	40	45	66	56	57	58	55	53
Pennsylvania	34	40	41	45	62	58	57	59	54	52
Delaware	30	31	34	38	57	49	49	49	47	42
Maryland	30	35	36	41	58	51	51	50	48	45
Virginia	38	35	38	49	59	52	53	59	53	55
West Virginia	40	37	45	50	65	54	64	64	53	55
North Carolina	43	43	47	57	73	60	61	62	64	68
South Carolina	49	46	50	64	84	69	69	70	74	73
Georgia	48	48	50	57	82	73	69	71	70	67
Florida	55	50	53	60	85	77	73	75	66	62
Ohio	25	27	30	34	57	42	47	46	43	39
Indiana	21	25	27	32	55	36	36	41	38	36
Illinois	21	25	26	32	57	36	36	39	38	36
Michigan	27	34	36	37	52	52	46	52	46	44
Wisconsin	25	28	30	33	52	50	43	46	42	41
Minnesota	24	24	24	29	45	40	38	36	33	34
Iowa	17	23	23	27	52	33	38	33	34	32
Missouri	24	27	30	32	67	33	34	44	37	38
North Dakota	32	36	33	42	46	45	42	40	36	39
South Dakota	21	23	26	29	45	41	35	36	31	29
Nebraska	17	22	23	31	54	30	28	33	32	29
Kansas	22	26	25	32	63	34	36	41	33	32
Kentucky	35	27	37	40	61	42	56	49	43	42
Tennessee	36	29	39	49	65	47	49	50	50	47
Alabama	46	41	47	58	77	67	57	60	64	64
Mississippi	45	39	46	58	74	61	54	56	65	61
Louisiana	45	41	44	50	75	66	58	57	61	60
Texas	41	34	36	47	80	66	48	52	49	50
Indian Territory					76	43	39	40	37	32
Oklahoma			20	26	76	39	38	39	32	30
Arkansas	40	29	38	43	81	49	51	53	55	47
Montana	65	66	52	59	90	72	62	68	68	65
Wyoming	50	55	42	60	72	59	58	57	75	59
Colorado	38	40	43	48	74	59	54	54	47	50
New Mexico	58	56	58	64	77	78	75	78	69	72
Arizona					90	101	90	91	97	85
Utah	55	60	59	63	90	67	70	72	70	74
Idaho					60	62	57	70	66	56
Washington	55	42	55	59	58	65	55	66	60	55
Oregon	53	60	64	57	57	66	67	61	59	65
California	56	62	60	61	68	77	74	78	76	67
General average	26.3	28.7	30.3	35.7	60.5	40.3	42.5	44.1	41.2	39.9

Wholesale prices of corn per bushel in leading cities of the United States, 1902–1906.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Detroit.		St. Louis.		San Francisco.	
	No. 2.		Mixed.		No. 2.		No. 2.		No. 2.		No. 2.		No. 1, white (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
January	66	72¼	58½	69½	62	68½	56½	64½	57	67¾	59	69¼	$1.30	$1.45
February	66½	71¼	60¼	68½	61	64½	56⅝	61¼	59	62	58½	63	1.35	1.45
March	65	71½	63	68	62	64	56	61⅛	59	61½	59	63	1.35	1.42½
April	65½	73	63½	69	60½	67½	56¾	64½	59½	64½	59¾	67	1.40	1.45
May	66⅞	73	66½	70	64	67¼	59⅛	64¾	63½	65½	62½	66	1.55	1.60
June	68¾	71½	67½	72	63½	66½	61	71½	63¼	66½	62	67	1.55	1.65
July	65¾	73	67	77	63½	69	56	88	66	67	61	66	1.52½	1.60
August	63½	69½	59	67	58	64	54	60	66	67	54	61½	1.45	1.60
September	67½	72½	64	69	60	63½	57	62½	55¾	59½	56½	60½	1.45	1.65
October	67½	70½	65	69	60	62½	55	61½	57½	60	56	58½	1.45	1.60
November	61½	67	47	68	45	60	52¾	58	60	66½	44½	49	1.42½	1.60
December	57	64	43½	55¼	44	50	43¾	57¼	66½	70½	40½	49½	1.47½	1.65
1903.														
January	55	68½	51½	60	43½	48½	43¾	48⅛	47	49	40	44½	1.30	1.40
February	55¾	59	52½	55	46	48	42½	45	47	48	41	44¾	1.30	1.37½
March	50⅞	56¼	47¾	52¾	41½	47	41⅜	45⅝	40½	47½	39	45	1.17½	1.35
April	51	53½	48½	52½	40	46	41¾	45¼	41½	45½	39½	42½	1.17½	1.27½
May	52¾	55	51	55½	45½	47¾	44	46	46½	48	41½	47½	1.17½	1.27½
June	56	60⅝	54½	59	48½	54	47¼	52	49½	55	48	55	1.20	1.30
July	56⅛	60	58½	61	50	53	49	53	51	55½	48	51¾	1.25	1.57½
August	58¼	60¼	58	60	52½	54½	50½	53	54½	55½	48	51½	1.55	1.57½
September	53¼	59¾	56	60	48	53	45¼	52¾	51	56½	45	50	1.47½	1.57½
October	51¼	54	53	55	45½	49	43½	46	47½	51½	41½	45	1.30	1.50
November	49¼	52⅜	46½	54½	45½	46	41⅜	44¾	46½	48½	41½	43¼	1.25	1.35
December	49½	53½	46¾	49¼	44½	46	41	43¾	44	48½	41½	45	1.25	1.35
1904.									No. 3.					
January	51½	56	49¼	50⅝	45½	46½	42¾	47½	42	44	43½	45½	1.27½	1.32½
February	53	63	49⅞	54½	45½	47½	46	54½	43½	46	44½	48½	1.25	1.35
March	54¼	57	50¼	52¾	46	51	49	56½	44½	46½	44	49¼	1.30	1.45
April	52¾	56	50⅛	52½	50½	54	46½	56⅞	48½	51½	48	51½	1.37½	1.45
May	55½	60	51½	54	51½	56½	47¼	50	51	52½	48	54	1.42½	1.45
June	47⅛	50½	50½	53¾	48	51	53¼	59½	48½	52	47	50½	1.40	1.47½
July	53½	55⅜	50½	53¼	48	53½	47¼	50	49	51½	48½	52¾	1.40	1.55
August	55⅜	62⅛	53½	58½	52½	57½	51¼	55¾	51½	57½	51½	55	1.40	1.55
September	56½	60¼	56½	58¾	55	57	51	54¾	53½	54½	51	54	1.50	1.55
October	55⅝	62¼	......	......	55½	59	50	57¼	52	58½	51½	54½	1.40	1.55
November	54⅞	69	53	55	56½	58½	50	58⅛	47½	60	48½	57	1.37½	1.55
December	53	54¾	49¾	52½	45½	52	43½	49	44½	47¾	42½	49	1.25	1.55
1905.														
January	51¼	52½	44¼	50½	45½	46	42	43¼	45	46¾	43¾	45	1.25	1.55
February	51	54⅜	44	50¾	46	48½	42¾	45½	45½	48½	44	47	1.32½	1.45
March	52	54¾	45½	54	48	52	45½	48½	48½	51½	46	49	1.32½	1.40
April	51	52¾	48	52½	47½	50½	46	49½	49½	50	46¼	49½	1.32½	1.40
May	52	58¼	48¼	56½	49	54½	48	64½	49½	54	48	53	1.32½	1.50
June	57¾	62½	50¾	64	54	57	51¾	56¾	54	57¼	50½	56	1.40	1.45
July	59¾	63½	58	65	57	59½	53¾	59	57¼	58	51	58½	1.40	1.42½
August	60	62¾	56	63½	54	57½	53	57	55½	57	51½	54½	1.40	1.42½
September	59	61	56	63	54½	56½	51¼	54½	54½	55½	51½	54½	1.32½	1.40
October	58¼	62½	51	63	53½	56½	50	54½	55½	59	50	53½	1.30	1.32½
November	52½	62½	42	61	45½	53	45½	51½	44¾	55½	41½	51½	1.30	1.37½
December	50¾	53¼	42	51½	44½	47	42	50¼	44¾	45¾	41½	46½	1.32½	1.37½
1906.														
January	49½	51¼	47¾	49⅞	44	46	41	43	44½	45¾	41¾	43¾	......	......
February	47	49¾	45⅝	48⅜	42	44¾	41¼	45½	43	46¾	39¾	42⅝	......	......
March	47¼	52	46	49⅜	43	48	39	44	43¼	47	40¼	44½	......	......
April	52	56¼	49⅝	54¼	47	52½	43½	48	48½	52	43½	51½	......	......
May	55¾	58	55	57¼	51½	53½	47½	50	50¾	53½	49	51	......	......
June	58	61½	55	58	51½	54	50	54¾	52	55	48	53½	......	......
July	56¾	60	55¼	57¾	53½	55½	49½	53¼	53	55	50½	54½	......	......
August	55	58	54¼	55¾	50½	54¼	48½	51	52¼	54	46½	51	......	......
September	56¼	58½	53½	54¾	48	50½	47	50	49	52	46	47½	......	......
October	54¼	56½	51⅛	54½	48	50	44¾	47¼	48¼	49¾	44	46	......	......
November	52¾	56	49	52	47½	48½	44	47¼	48¾	49¾	41	45½	......	......
December	50	53	50	51½	43	48	40	46	43½	49½	39½	45	......	......

Condition of the corn crop of the United States, monthly, 1892–1906.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1892	81.1	82.5	79.6	79.8	1897	82.9	84.2	79.3	77.1	1902	87.5	86.5	84.3	79.6
1893	93.2	87.0	76.7	75.1	1898	90.5	87.0	84.1	82.0	1903	79.4	78.7	80.1	80.8
1894	95.0	69.1	63.4	64.2	1899	86.5	89.9	85.2	82.7	1904	86.4	87.3	84.6	83.9
1895	99.3	102.5	96.4	95.5	1900	89.5	87.5	80.6	78.2	1905	87.3	89.0	89.5	89.2
1896	92.4	96.0	91.0	90.5	1901	81.3	54.0	51.7	52.1	1906	87.5	88.1	90.2	90.1

WHEAT.

Wheat crop of countries named, 1902–1906.

[Substantially the crop of the world.]

Country.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	670,063,000	637,822,000	552,400,000	692,979,000	735,261,000
Canada:					
New Brunswick	468,000	471,000	371,000	418,000	420,000
Ontario	26,904,000	22,583,000	13,030,000	22,195,000	22,806,000
Manitoba	54,750,000	41,381,000	40,397,000	57,519,000	63,181,000
Saskatchewan	13,524,000	15,598,000	16,447,000	26,930,000	38,207,000
Alberta	877,000	1,238,000	968,000	2,379,000	3,896,000
Other	4,000,000	4,000,000	4,000,000	4,000,000	4,000,000
Total Canada	100,523,000	85,271,000	75,213,000	113,441,000	132,510,000
Mexico	8,477,000	10,493,000	9,393,000	5,000,000	5,000,000
Total North America	779,063,000	733,586,000	637,006,000	811,420,000	872,771,000
SOUTH AMERICA.					
Argentina	56,380,000	103,759,000	129,672,000	150,745,000	134,931,000
Chile	10,641,000	10,114,000	17,948,000	20,000,000	15,800,000
Uruguay	7,604,000	5,240,000	7,565,000	6,000,000	4,606,000
Total South America	74,625,000	119,113,000	155,185,000	176,745,000	155,337,000
EUROPE.					
Austria-Hungary:					
Austria	49,655,000	46,198,000	53,734,000	54,531,000	58,255,000
Hungary proper	170,884,000	161,958,000	137,078,000	157,512,000	197,408,000
Croatia-Slavonia	12,017,000	14,664,000	9,841,000	13,077,000	10,343,000
Bosnia-Herzegovina	2,384,000	3,901,000	3,753,000	3,016,000	2,693,000
Total Austria-Hungary	234,940,000	226,721,000	204,406,000	228,136,000	268,699,000
Belgium	14,521,000	12,350,000	13,817,000	12,401,000	13,000,000
Bulgaria	35,000,000	35,551,000	42,242,000	40,736,000	55,076,000
Denmark	4,528,000	4,461,000	4,302,000	4,083,000	4,400,000
Finland	79,000	130,000	133,000	130,000	130,000
France	327,841,000	364,320,000	298,826,000	335,453,000	324,725,000
Germany	143,315,000	130,626,000	139,803,000	135,947,000	144,754,000
Greece	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000
Italy	136,210,000	184,451,000	167,635,000	160,504,000	168,000,000
Montenegro	200,000	200,000	200,000	200,000	200,000
Netherlands	5,105,000	4,258,000	4,423,000	5,109,000	4,700,000
Norway	265,000	307,000	212,000	329,000	300,000
Portugal	10,400,000	8,000,000	6,500,000	5,000,000	8,000,000
Roumania	76,220,000	73,700,000	53,738,000	103,328,000	113,867,000

Wheat crop of countries named, 1902–1906—Continued.

Country.	1902.	1903.	1904.	1905.	1906.
EUROPE—continued					
Russia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Russia proper	463,258,000	454,596,000	519,964,000	451,327,000	358,000,000
Poland	20,349,000	19,255,000	21,241,000	20,239,000	19,000,000
Northern Caucasia [a]	77,069,000	77,941,000	81,132,000	96,817,000	73,000,000
Total Russia (European)	560,676,000	551,792,000	622,337,000	568,383,000	450,000,000
Servia	11,409,000	10,885,000	11,676,000	11,262,000	13,211,000
Spain	133,523,000	128,979,000	95,377,000	92,054,000	154,090,000
Sweden	4,757,000	5,538,000	5,135,000	5,529,000	6,227,000
Switzerland	4,200,000	4,000,000	4,000,000	4,000,000	4,000,000
Turkey (European)	25,000,000	26,000,000	23,000,000	20,000,000	22,000,000
United Kingdom:					
Great Britain—					
England	55,216,000	46,524,000	35,624,000	57,424,000	57,583,000
Scotland	1,856,000	1,528,000	1,499,000	2,130,000	2,063,000
Wales	1,391,000	1,093,000	919,000	1,204,000	1,308,000
Ireland	1,602,000	1,176,000	1,040,000	1,430,000	1,400,000
Total United Kingdom	60,065,000	50,321,000	39,082,000	62,188,000	62,354,000
Total Europe	1,796,254,000	1,830,590,000	1,744,844,000	1,802,772,000	1,825,733,000
ASIA.					
British India, including native states where reporting	227,380,000	297,601,000	359,936,000	283,063,000	319,586,000
Cyprus	897,000	2,477,000	2,176,000	2,000,000	2,000,000
Japanese Empire:					
Japan	20,243,000	9,600,000	19,754,000	18,437,000	18,000,000
Formosa	107,000	179,000	190,000	200 000	200,000
Total Japanese Empire	20,350,000	9,779,000	19,944,000	18,637,000	18,200,000
Persia	13,600,000	16,000,000	16,000,000	16,000,000	16,000,000
Russia:					
Central Asia	15,897,000	20,995,000	12,822,000	25,491,000	21,000,000
Siberia	30,796,000	48,670,000	31,590,000	42,411,000	35,000,000
Total Russia (Asiatic)	46,693,000	69,665,000	44,412,000	67,902,000	56,000,000
Turkey (Asiatic)	35,000,000	33,000,000	33,000,000	33,000,000	33,000,000
Total Asia	343,920,000	428,522,000	475,468,000	420,602,000	444,786,000
AFRICA.					
Algeria	33,896,000	34,035,000	25,484,000	20,000,000	28,000,000
Cape of Good Hope	2,000,000	1,755,000	2,000,000	2,000,000	2,000,000
Egypt	12,000,000	11,000,000	12,000,000	12,000,000	12,000,000
Natal	4,000	4,000	7,000	4,000	4,000
Sudan (Anglo-Egyptian)	300,000	294,000	486,000	483,000	400,000
Tunis	4,127,000	7,523,000	10,519,000	5,729,000	4,409,000
Total Africa	52,327,000	54,611,000	50,496,000	40,216,000	46,813,000
AUSTRALASIA.					
Australia:					
Queensland	1,746,000	6,000	2,514,000	2,217,000	1,173,000
New South Wales	15,275,000	1,635,000	28,196,000	16,983,000	21,391,000
Victoria	12,510,000	2,650,000	29,425,000	21,666,000	24,156,000
South Australia	8,265,000	6,555,000	13,626,000	12,454,000	20,779,000
Western Australia	963,000	1,017,000	1,935,000	2,077,000	2,381,000
Tasmania	994,000	905,000	792,000	818,000	801,000
Total Australian Commonwealth	39,753,000	12,768,000	76,488,000	56,215,000	70,681,000
New Zealand	4,174,000	7,693,000	8,140,000	9,411,000	7,013,000
Total Australasia	43,927,000	20,461,000	84,628,000	65,626,000	77,694,000
Grand total	3,090,116,000	3,186,883,000	3,147,627,000	3,317,381,000	3,423,134,000

[a] Includes government of Chernomorsk.

International trade in wheat, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	33,226,924	23,696,306	61,778,175	84,084,087	105,391,256
Australia	Jan. 1	20,200,058	8,999,282	1,172,838	33,071,653	24,648,182
Austria-Hungary	Jan. 1	781,810	518,528	603,379	117,282	49,321
Belgium	Jan. 1	13,167,736	12,467,375	11,751,205	14,803,081	14,639,453
British India	Apr. 1	13,773,674	19,542,525	48,000,225	80,475,855	35,171,216
Bulgaria	Jan. 1	4,901,652	8,624,508	12,234,810	19,240,949	16,542,617
Canada	Jan. 1	26,117,530	32,985,745	16,779,028	14,700,315	40,399,402
Chile	Jan. 1	57,350	918,661	1,979,146	2,718,470	294,201
Germany [b]	Jan. 1	3,410,976	3,019,553	6,626,109	5,864,239	6,050,111
Netherlands	Jan. 1	37,427,119	36,979,823	39,740,530	40,681,553	53,052,451
Roumania	Jan. 1	29,889,627	33,750,616	30,611,933	26,107,148	63,066,299
Russia	Jan. 1	83,408,574	111,977,478	153,448,855	169,058,196	176,789,611
Servia	Jan. 1	2,186,913	1,855,771	1,841,636	3,656,539	3,422,554
United States	July 1	154,856,102	114,181,420	44,230,169	4,394,402	34,973,291
Other countries		9,593,611	9,054,989	4,547,909	5,294,121	3,608,798
Total		424,059,656	418,572,590	435,946,057	504,268,487	578,068,263

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Belgium	Jan. 1	54,934,824	57,062,144	59,497,821	63,979,207	64,789,961
Brazil	Jan. 1	4,209,246	5,501,214	6,200,299	7,112,130	7,873,514
Denmark	Jan. 1	5,070,715	4,329,013	3,686,313	3,861,670	3,447,768
Finland	Jan. 1	1,504	11,118	3,759	6,878	4,215
France	Jan. 1	5,816,851	9,029,614	17,365,172	7,589,048	6,713,342
Germany [b]	Jan. 1	78,418,416	76,225,923	70,882,595	74,203,743	84,054,403
Greece	Jan. 1	6,389,060	6,275,321	6,109,739	5,132,775	5,773,503
Italy	Jan. 1	38,444,603	47,274,048	43,115,829	29,617,847	58,687,589
Japan	Jan. 1	190,823	192,298	2,812,509	888,558	2,281,022
Netherlands	Jan. 1	48,145,253	47,293,883	49,668,874	50,510,097	61,992,589
Portugal	Jan. 1	3,392,048	336,955	2,748,269	3,282,298	4,672,573
Spain	Jan. 1	5,273,168	2,556,594	3,336,229	8,192,327	32,517,785
Sweden	Jan. 1	6,321,228	7,510,655	8,228,201	8,082,561	7,255,222
Switzerland	Jan. 1	14,253,502	15,226,501	16,324,627	17,220,343	16,158,553
United Kingdom	Jan. 1	129,557,082	150,893,574	164,206,762	181,984,012	181,579,827
Other countries		13,693,372	15,741,532	23,589,694	21,296,518	9,409,308
Total		414,111,705	441,460,347	477,786,292	483,011,732	527,170,814

[a] See "General note" p. 546.

[b] Not including free ports.

International trade in wheat flour, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
Argentina	Jan. 1	806,959	439,125	809,636	1,266,836	1,628,271
Australia	Jan. 1	987,898	336,949	62,214	1,052,500	1,573,663
Austria-Hungary	Jan. 1	978,543	1,114,607	1,095,357	859,446	795,853
Belgium	Jan. 1	208,906	316,272	358,132	758,648	857,017
British India	Apr. 1	302,473	410,330	463,098	589,426	512,329
Bulgaria	Jan. 1	146,246	154,697	211,311	232,315	214,587
Canada	Jan. 1	1,086,648	1,287,766	1,587,600	1,321,469	1,532,014
Chile	Jan. 1	3,959	27,827	64,796	95,099	83,673
Germany [b]	Jan. 1	325,498	227,802	295,698	616,939	991,701
Netherlands	Jan. 1	80,566	82,218	106,207	130,372	199,777
Roumania	Jan. 1	269,970	214,505	277,557	135,900	484,511
Russia	Jan. 1	728,631	643,285	1,025,773	1,172,442	970,808
Servia	Jan. 1	8,849	4,402	38,827	9,286	21,798
United States	July 1	17,759,203	19,716,484	16,999,432	8,826,335	13,919,048
Other countries		1,105,783	1,209,786	1,058,533	1,258,028	5,169,334
Total		24,800,132	26,186,055	24,454,171	18,265,101	28,954,384

[a] See "General note" p. 546.

[b] Not including free ports.

International trade in wheat flour, 1901–1906—Continued.

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Barrels.	*Barrels*	*Barrels.*	*Barrels.*	*Barrels.*
Belgium	Jan. 1	232,909	99,022	66,507	40,255	41,516
Brazil	Jan. 1	1,592,173	1,187,695	1,317,531	1,474,049	1,579,944
Denmark	Jan. 1	350,992	379,836	467,774	416,460	552,978
Finland	Jan. 1	574,505	670,193	764,152	757,085	794,748
France	Jan. 1	282,625	328,927	255,777	232,150	140,854
Germany [a]	Jan. 1	432,713	354,818	359,704	260,600	240,560
Greece	Jan. 1	23,088	26,866	21,762	16,584	28,942
Italy	Jan. 1	14,637	12,476	13,085	11,700	12,513
Japan	Jan. 1	425,002	496,633	1,411,611	1,291,886	1,242,880
Netherlands	Jan. 1	2,030,724	1,879,773	1,974,151	1,868,040	1,863,924
Spain	Jan. 1	33,930	14,178	6,002	13,694	663,283
Sweden	Jan. 1	86,527	98,375	93,494	80,852	57,839
Switzerland	Jan. 1	481,506	406,907	379,004	411,596	386,597
United Kingdom	Jan. 1	12,714,516	11,040,771	11,754,350	8,384,319	6,779,846
Other countries		5,684,613	6,170,616	7,775,502	5,906,077	3,750,661
Total		24,960,460	23,167,086	26,660,406	21,165,347	18,137,085

[a] Not including free ports.

International trade in wheat, including flour, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Argentina	Jan. 1	36,858,240	25,672,368	65,421,537	90,115,119	112,718,476
Australia	Jan. 1	24,705,599	10,515,552	1,452,801	37,807,903	31,729,666
Austria-Hungary	Jan. 1	5,185,254	5,534,270	5,532,485	3,984,789	3,630,659
Belgium	Jan. 1	14,107,813	13,890,599	13,362,799	18,217,597	18,496,029
British India	Apr. 1	15,134,802	21,389,010	50,684,276	83,128,272	37,476,096
Bulgaria	Jan. 1	5,559,759	9,320,644	13,185,710	20,286,368	17,508,259
Canada	Jan. 1	31,007,446	38,780,692	23,923,228	20,646,925	47,293,465
Chile	Jan. 1	75,166	1,043,883	2,270,728	3,146,416	670,729
Germany [b]	Jan. 1	4,875,717	4,044,662	7,956,750	8,640,465	10,512,765
Netherlands	Jan. 1	37,789,666	37,349,804	40,218,462	41,268,227	53,951,447
Roumania	Jan. 1	22,104,492	34,715,888	31,860,939	26,718,698	65,246,599
Russia	Jan. 1	86,687,414	114,872,260	158,064,833	174,334,182	181,158,247
Servia	Jan. 1	2,226,733	1,875,580	2,016,358	3,098,326	3,520,645
United States	July 1	234,772,516	202,905,598	120,727,613	44,112,910	97,609,007
Other countries		14,569,635	14,499,026	9,311,307	10,955,247	26,870,401
Total		535,660,252	536,409,836	545,989,826	586,461,444	708,393,090

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Belgium	Jan. 1	55,982,914	57,507,743	59,797,103	64,160,455	64,976,813
Brazil	Jan. 1	11,374,024	10,845,842	12,129,189	13,745,350	14,983,262
Denmark	Jan. 1	6,650,179	6,038,275	5,791,296	5,735,740	5,935,769
Finland	Jan. 1	2,586,776	3,026,986	3,442,444	3,413,760	3,580,581
France	Jan. 1	7,088,663	10,509,786	18,516,168	8,625,293	7,347,185
Germany [b]	Jan. 1	80,365,624	77,822,604	72,501,263	75,436,443	85,136,923
Greece	Jan. 1	6,492,956	6,396,218	6,207,668	5,207,403	5,863,742
Italy	Jan. 1	38,510,469	43,330,190	43,174,711	29,670,497	38,743,897
Japan	Jan. 1	2,103,342	2,427,146	9,164,759	6,702,045	7,873,982
Netherlands	Jan. 1	57,283,511	55,752,861	58,552,554	58,916,277	70,380,247
Portugal	Jan. 1	3,393,200	336,955	2,748,269	3,282,298	4,672,573
Spain	Jan. 1	5,425,853	2,620,395	3,368,238	8,253,950	35,502,559
Sweden	Jan. 1	6,710,600	7,953,343	8,658,924	8,446,395	7,515,498
Switzerland	Jan. 1	16,420,279	17,057,583	18,030,145	19,072,525	17,898,240
United Kingdom	Jan. 1	186,772,404	200,577,004	217,100,937	219,713,496	212,089,144
Other countries		39,272,978	43,509,304	58,579,453	47,873,864	26,287,282
Total		526,433,772	545,712,235	597,758,121	578,255,793	608,787,697

[a] See "General note," p. 546.

[b] Not including free ports.

World's visible supply of wheat, first of each month, for ten years. [a]

Month.	1897-98.	1898-99.	1899-1900.	1900-1901.	1901-2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	88,378,000	86,773,000	140,299,000	149,839,000	135,692,000
August	77,590,000	70,101,000	134,525,000	150,193,000	132,379,000
September	87,075,000	66,511,000	142,595,000	164,629,000	141,071,000
October	119,162,000	83,090,000	162,877,000	188,200,000	159,465,000
November	139,321,000	106,886,000	191,189,000	200,892,000	169,854,000
December	156,016,000	135,846,000	203,477,000	203,237,000	202,108,000
January	157,008,000	147,197,000	200,388,000	200,534,000	200,990,000
February	151,717,000	146,458,000	190,535,000	197,851,000	202,278,000
March	140,571,000	151,124,000	181,527,000	192,749,000	191,877,000
April	132,037,000	144,950,000	184,141,000	187,817,000	179,789,000
May	111,233,000	139,521,000	175,776,000	171,753,000	155,486,000
June	109,845,000	136,952,000	159,405,000	152,518,000	131,255,000

Month.	1902-3.	1903-4.	1904-5.	1905-6.	1906-7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	103,671,000	95,820,000	118,073,000	114,302,000	124,081,000
August	93,944,000	87,566,000	103,740,000	106,838,000	....
September	102,364,000	96,907,000	115,183,000	113,511,000	141,459,000
October	133,376,000	132,972,000	144,400,000	138,759,000	170,474,000
November	163,491,000	145,618,000	170,240,000	157,735,000	195,739,000
December	179,483,000	161,891,000	186,891,000	189,323,000	215,930,000
January	174,640,000	167,712,000	178,710,000	192,690,000	208,351,000
February	168,170,000	159,464,000	171,124,000	188,030,000	193,548,000
March	163,658,000	152,035,000	165,370,000	193,520,000	198,026,000
April	149,748,000	147,859,000	155,744,000	183,687,000	....
May	127,088,000	145,840,000	141,734,000	159,406,000	....
June	112,963,000	133,190,000	123,770,000	139,154,000	....

a From Broomhall's Corn Trade News.

Visible supply of wheat in the United States and Canada, first of each month, for ten years.

EAST OF ROCKY MOUNTAINS. [a]

Month.	1897-98.	1898-99.	1899-1900.	1900-1901.	1901-2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	27,090,000	18,069,000	46,544,000	59,063,000	37,819,000
August	23,793,000	11,430,000	49,155,000	60,398,000	40,924,000
September	20,362,000	10,499,000	48,087,000	69,003,000	42,242,000
October	31,508,000	22,857,000	60,040,000	76,071,000	53,790,000
November	42,609,000	33,930,000	77,195,000	82,238,000	64,616,000
December	49,859,000	45,914,000	84,687,000	89,591,000	85,631,000
January	54,173,000	51,057,000	89,252,000	88,456,090	94,900,000
February	51,105,000	51,648,000	87,473,000	86,324,000	88,800,000
March	45,021,000	51,085,000	83,935,000	79,300,000	82,790,000
April	40,577,000	51,747,000	77,113,000	73,879,000	73,576,000
May	31,039,000	47,258,000	70,764,000	60,298,000	54,610,000
June	27,479,000	42,092,000	57,617,000	47,109,000	37,676,000

Month.	1902-3.	1903-4.	1904-5.	1905-6.	1906-7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	26,786,000	24,142,000	21,131,000	20,476,000	33,810,000
August	31,436,000	21,480,000	19,508,000	21,314,000	39,633,000
September	33,579,000	22,824,000	20,905,000	21,705,000	43,611,000
October	44,217,000	33,043,000	29,230,000	28,894,000	56,967,000
November	67,490,000	49,269,000	41,252,000	53,745,000	45,694,000
December	78,352,000	59,050,000	54,387,000	62,402,000	51,862,000
January	80,769,000	55,961,000	56,892,000	71,634,000	56,137,000
February	81,348,000	55,818,000	54,597,000	73,151,000	54,344,000
March	76,336,000	55,459,000	52,907,000	70,530,000	51,338,000
April	67,954,000	49,639,000	46,865,000	66,599,000	49,813,000
May	52,585,000	45,307,000	40,158,000	54,856,000	52,482,000
June	36,040,000	29,685,000	28,532,000	40,347,000	....

a The figures for stocks east of the Rocky Mountains represent 62 principal points of accumulation, including Manitoba elevators and stocks afloat on lakes and canals, as reported by Bradstreet's.

Visible supply of wheat in the United States and Canada, first of each month, for ten years—Continued.

PACIFIC COAST.

Month.	1897-98.	1898-99.	1899-1900.	1900-1901.	1901-2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	1,112,000	2,935,000	3,409,000	5,903,000	3,228,000
August	2,247,000	2,608,000	4,188,000	5,770,000	3,935,000
September	4,651,000	3,065,000	6,282,000	7,483,000	4,266,000
October	6,251,000	4,671,000	8,858,000	10,208,000	6,235,000
November	7,391,000	5,621,000	11,085,000	9,983,000	7,262,000
December	6,944,000	6,269,000	10,678,000	10,057,000	7,378,000
January	6,661,000	5,923,000	9,022,000	8,686,000	7,186,000
February	5,318,000	5,030,000	8,923,000	8,717,000	6,521,000
March	4,424,000	5,104,000	7,814,000	6,972,000	5,542,000
April	3,466,000	4,321,000	7,207,000	6,325,000	5,428,000
May	3,051,000	4,455,000	7,050,000	5,084,000	3,685,000
June	3,256,000	3,635,000	6,866,000	4,672,000	3,139,000
Month.	**1902-3.**	**1903-4.**	**1904-5.**	**1905-6.**	**1906-7.**
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	2,725,000	1,775,000	1,668,000	839,000	2,586,000
August	2,345,000	1,400,000	1,351,000	581,000	1,898,000
September	3,024,000	1,798,000	1,582,000	1,130,000	1,943,000
October	4,737,000	3,227,000	4,106,000	3,156,000	3,431,000
November	4,719,000	3,447,000	3,874,000	4,486,000	3,459,000
December	5,361,000	3,591,000	3,733,000	5,866,000	2,689,000
January	4,992,000	3,282,000	3,458,000	5,511,000	2,647,000
February	4,373,000	2,689,000	3,051,000	5,295,000	2,059,000
March	3,435,000	2,930,000	1,673,000	4,898,000	1,744,000
April	3,810,000	2,472,000	2,486,000	4,621,000	1,661,000
May	3,683,000	2,078,000	1,860,000	3,917,000	1,731,000
June	2,546,000	2,078,000	1,461,000	3,349,000	....

Statement showing the amount of wheat in farmers' hands, the visible supply of the United States and Canada, and of the world, on March 1, 1892–1907.

Year.	Stocks in farmers' hands in United States.	Visible supply of the United States and Canada.	Visible supply of the world.
	Bushels.	*Bushels.*	*Bushels.*
1892	171,070,881	68,007,000	181,400,000
1893	135,205,430	110,693,000	229,300,000
1894	114,059,560	105,863,000	222,400,000
1895	74,999,790	110,546,000	212,400,000
1896	123,045,290	98,834,000	0191,900,00
1897	88,149,072	63,521,000	155,500,000
1898	121,320,500	49,445,000	140,600,000
1899	198,056,496	56,189,000	151,100,000
1900	158,745,595	91,749,000	181,500,000
1901	128,098,074	86,272,000	192,700,000
1902	173,702,583	88,332,000	191,900,000
1903	164,047,106	79,771,000	163,700,000
1904	132,608,382	58,389,000	152,000,000
1905	111,054,959	54,580,000	165,400,000
1906	158,403,478	75,428,000	193,520,000
1907	206,641,798	53,082,000	198,026,000

Condition of the wheat crop of the United States, monthly, 1888–1907.

Year.	December of previous year.	Winter wheat.					Spring wheat.			
		April.	May.	June.	July.	When harvested.	June.	July.	August.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1888	95.9	82.0	73.1	73.3	75.6	77.4	92.8	95.9	87.3	77.2
1889	96.8	94.0	96.0	93.1	92.0	89.4	94.4	83.3	81.2	83.8
1890	95.3	81.0	80.0	78.1	76.2	73.5	91.3	94.4	83.2	79.8
1891	98.4	96.9	97.9	96.6	96.2	96.7	92.6	94.1	95.5	97.2
1892	85.3	81.2	84.0	88.3	89.6	87.6	92.3	90.9	87.3	81.2
1893	87.4	77.4	75.3	75.5	77.7	[a] 74.0	86.4	74.1	67.0	....
1894	91.5	86.7	81.4	83.2	83.9	[a] 83.7	88.0	68.4	67.1	....
1895	89.0	81.4	82.9	71.1	65.8	[a] 75.4	97.8	102.2	95.9	....
1896	81.4	77.1	82.7	77.9	75.6	[a] 74.6	99.9	93.3	78.9	....
1897	99.5	81.4	80.2	78.5	81.2	[a] 85.7	89.6	91.2	86.7	....
1898	....	86.7	86.5	90.8	85.7	[a] 86.7	100.9	95.0	96.5	....
1899	92.6	77.9	76.2	67.3	65.6	[a] 70.9	91.4	91.7	83.6	....
1900	97.1	82.1	88.9	82.7	80.8	[a] 69.6	87.3	55.2	56.4	....
1901	97.1	91.7	94.1	87.8	88.3	[a] 82.8	92.0	95.6	80.3	....
1902	86.7	78.7	76.4	76.1	77.0	[a] 80.0	95.4	92.4	89.7	....
1903	99.7	97.3	92.6	82.2	78.8	[a] 74.7	95.9	82.5	77.1	....
1904	86.6	76.5	76.5	77.7	78.7	....	93.4	93.7	87.5	66.2
1905	82.9	91.6	92.5	85.5	82.7	....	93.7	91.0	89.2	87.3
1906	94.1	89.1	90.9	82.7	85.6	....	93.4	91.4	86.9	83.4
1907	94.1	89.9	82.9	....	....	....	....	....	....	....

[a] Includes both winter and spring.

Acreage, production, value, prices, and exports of wheat in the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel.				Domestic exports, including flour, fiscal year beginning July 1.
						December.		May of following year.		
						Low.	High.	Low.	High.	
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1866	15,424,496	9.9	151,999,906	152.7	232,109,630	129	145	185	211	12,646,941
1867	18,321,561	11.6	212,441,400	145.2	308,387,146	126	140	134	161	25,284,803
1868	18,460,132	12.1	224,036,600	108.5	243,032,746	80	88	87	96	29,717,201
1869	19,181,004	13.6	260,146,900	76.5	199,024,996	63	76	79	92	53,900,780
1870	18,992,591	12.4	235,884,700	94.4	222,766,969	91	98	113	120	52,580,111
1871	19,943,893	11.6	230,722,400	114.5	264,075,851	107	111	120	143	38,995,755
1872	20,858,359	11.9	249,997,100	111.4	278,522,068	97	108	112	122	52,014,715
1873	22,171,676	12.7	281,254,700	106.9	300,669,528	96	106	105	114	91,510,398
1874	24,967,027	12.3	308,102,700	86.3	265,881,167	78	83	78	94	72,912,817
1875	26,381,512	11.1	292,136,000	89.5	261,396,926	82	91	89	100	74,750,682
1876	27,627,021	10.5	289,356,500	96.3	278,697,238	104	117	130	172	57,043,936
1877	26,277,546	13.9	364,194,146	105.7	385,089,444	103	108	98	113	92,071,726
1878	32,108,560	13.1	420,122,400	77.6	325,814,119	81	84	91	102	150,502,506
1879	32,545,950	13.8	448,756,630	110.8	497,030,142	122	133½	112½	119	180,304,180
1880	37,986,717	13.1	498,549,868	95.1	474,201,850	93½	109¾	101	112⅝	186,321,514
1881	37,709,020	10.2	383,280,090	119.2	456,880,427	124¾	129	123	140	121,892,389
1882	37,067,194	13.6	504,185,470	88.4	445,602,125	91⅛	94¾	108	113⅜	147,811,316
1883	36,455,593	11.6	421,086,160	91.1	383,649,272	94⅝	99¼	85	94¾	111,534,182
1884	39,475,885	13.0	512,765,000	64.5	330,862,260	69½	76⅜	85⅜	90¾	132,570,366
1885	34,189,246	10.4	357,112,000	77.1	275,320,390	82⅞	89	72⅛	79	94,565,793
1886	36,806,184	12.4	457,218,000	68.7	314,226,020	75⅛	79½	80¾	88¾	153,804,969
1887	37,641,783	12.1	456,329,000	68.1	310,612,960	75⅛	79¼	81¼	89⅞	119,625,344
1888	37,336,138	11.1	415,868,000	92.6	385,248,030	96⅝	105½	77¼	95½	88,600,742
1889	38,123,859	12.9	490,560,000	69.8	342,491,707	76¾	80½	89¾	100	109,430,467
1890	36,087,154	11.1	399,262,000	83.8	334,773,678	87½	92¾	98⅞	108	106,181,316
1891	39,916,897	15.3	611,780,000	83.9	513,472,711	89⅜	93¼	80	85¾	225,665,812
1892	38,554,430	13.4	515,949,000	62.4	322,111,881	69½	73	68¼	76¼	191,912,635
1893	34,629,418	11.4	396,131,725	53.8	213,171,381	59⅛	64½	52⅛	60½	164,283,129
1894	34,882,436	13.2	460,267,416	49.1	225,902,025	52¾	63⅝	60¾	85⅜	144,812,718
1895	34,047,332	13.7	467,102,947	50.9	237,938,998	53¾	64¾	57⅛	67⅝	126,443,968
1896	34,618,646	12.4	427,684,346	72.6	310,602,539	74⅝	93⅛	68¾	97⅞	145,124,972
1897	39,465,066	13.4	530,149,168	80.8	428,547,121	92	109	117	185	217,306,005
1898	44,055,278	15.3	675,148,705	58.2	392,770,320	62¾	70	68⅜	79½	222,618,420
1899	44,592,516	12.3	547,303,846	58.4	319,545,259	64	69½	63⅝	67½	186,096,762
1900	42,495,385	12.3	522,229,505	61.9	323,515,177	69¼	74⅝	70	75⅛	215,990,073
1901	49,895,514	15.0	748,460,218	62.4	467,350,156	73	79½	72⅜	76¼	234,772,516
1902	46,202,424	14.5	670,063,008	63.0	422,224,117	71⅞	77¾	74¾	80⅝	202,905,598
1903	49,464,967	12.9	637,821,835	69.5	443,024,826	77¾	87	87¾	101½	120,727,613
1904	44,074,875	12.5	552,399,517	92.4	510,489,874	115	122	89½	113¾	44,112,910
1905	47,854,079	14.5	692,979,489	74.8	518,372,727	82½	90	80¼	87¼	97,609,007
1906	47,305,829	15.5	735,260,970	66.7	490,332,760	72⅝	75	......	......	....

Acreage, production, value, and distribution of wheat in the United States in 1906, by States.

State or Territory.	Crop of 1906.			Stock in farmers' hands March 1, 1907.		Shipped out of county where grown.
	Acreage.	Production.	Value.			
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*Per cent.*	*Bushels.*
Maine	8,038	199,342	201,335	69,770	35	0
Vermont	1,388	30,952	26,619	9,595	31	0
New York	467,509	9,350,180	7,667,148	3,646,570	39	2,898,556
New Jersey	111,093	2,033,002	1,626,402	609,901	30	406,600
Pennsylvania	1,642,553	29,073,188	22,095,623	11,629,275	40	7,268,297
Delaware	121,745	1,947,920	1,383,023	681,772	35	1,051,877
Maryland	806,401	12,902,416	9,160,715	3,483,652	27	7,870,474
Virginia	744,546	9,306,825	7,538,528	2,978,184	32	2,512,843
West Virginia	384,241	4,879,861	3,952,687	1,610,354	33	683,181
North Carolina	582,091	5,297,028	4,926,236	1,748,019	33	370,792
South Carolina	318,284	2,960,041	3,256,045	651,209	22	59,201
Georgia	316,107	3,161,070	3,224,291	727,046	23	94,832
Ohio	2,117,750	43,202,100	30,673,491	15,120,735	35	22,465,092
Indiana	2,322,750	48,080,925	33,656,648	12,501,040	26	25,002,081
Illinois	1,976,200	38,535,900	26,589,771	9,633,975	25	19,267,950
Michigan	1,041,600	13,644,960	9,824,371	3,820,589	28	4,775,736
Wisconsin	288,040	4,690,816	3,377,387	1,735,602	37	422,173
Minnesota	5,119,412	55,801,591	36,271,034	16,740,477	30	39,619,130
Iowa	585,660	9,212,218	5,895,820	3,132,154	34	2,303,054
Missouri	2,144,250	31,734,900	21,262,383	7,299,027	23	15,550,101
North Dakota	5,992,000	77,896,000	49,074,480	24,926,720	32	66,211,600
South Dakota	3,131,000	41,955,400	25,592,794	12,167,066	29	32,725,212
Nebraska	2,376,560	52,288,692	29,804,554	16,732,381	32	35,556,311
Kansas	5,422,508	81,830,611	47,461,754	21,275,959	26	63,009,570
Kentucky	818,624	11,542,598	8,426,097	2,308,520	20	3,347,353
Tennessee	871,418	10,892,725	8,496,326	3,049,963	28	3,049,963
Alabama	98,639	1,085,029	1,019,927	217,006	20	10,850
Mississippi	1,761	17,610	15,321	0	0	0
Texas	1,228,364	14,126,186	10,877,163	1,836,404	13	3,672,808
Indian Territory	240,849	2,890,188	1,791,917	462,430	16	1,416,192
Oklahoma	1,333,133	18,663,862	10,265,124	4,665,966	25	12,318,149
Arkansas	177,338	1,915,250	1,436,438	497,965	26	114,915
Montana	137,389	3,297,336	2,110,295	1,220,014	37	857,307
Wyoming	30,352	871,102	635,904	348,441	40	43,555
Colorado	254,355	8,266,538	5,373,250	2,479,961	30	4,133,269
New Mexico	44,826	1,120,650	930,140	280,162	25	44,826
Arizona	15,542	391,658	403,408	86,165	22	15,666
Utah	178,417	4,888,626	3,177,607	1,955,450	40	1,564,360
Nevada	27,604	869,526	739,097	260,858	30	34,781
Idaho	336,736	8,231,631	4,938,979	2,634,122	32	4,609,713
Washington	1,204,201	25,075,258	15,546,660	4,262,794	17	19,558,701
Oregon	712,411	14,215,597	9,443,222	2,843,119	20	7,818,578
California	1,572,144	26,883,662	20,162,746	4,301,386	16	14,517,177
United States	47,305,829	735,260,970	490,332,760	206,641,798	28.1	427,252,826

Acreage, production, and farm value on December 1 of winter and spring wheat in the United States in 1906.

State or Territory.	Winter wheat.					Spring wheat.				
	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.
	Acres.	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*	*Acres.*	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*
Maine						8,038	24.8	199,342	101	201,335
Vermont						1,388	22.3	30,952	86	26,619
New York	467,509	20.0	9,350,180	82	7,667,148					
New Jersey	111,093	18.3	2,033,002	80	1,626,402					
Pennsylvania	1,642,553	17.7	29,073,188	76	22,095,623					
Delaware	121,745	16.0	1,947,920	71	1,383,023					
Maryland	806,401	16.0	12,902,416	71	9,160,715					
Virginia	744,546	12.5	9,306,825	81	7,538,528					
West Virginia	384,241	12.7	4,879,861	81	3,952,687					
North Carolina	582,091	9.1	5,297,028	93	4,926,236					
South Carolina	318,284	9.3	2,960,041	110	3,256,045					
Georgia	316,107	10.0	3,161,070	102	3,224,291					
Ohio	2,117,750	20.4	43,202,100	71	30,673,491					

Acreage, production, and farm value on December 1 of winter and spring wheat in the United States in 1906—Continued.

State or Territory.	Winter wheat.					Spring wheat.				
	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.
	Acres.	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*	*Acres.*	*Bu.*	*Bushels.*	*Cts.*	*Dollars.*
Indiana	2,322,750	20.7	48,080,925	70	33,656,648					
Illinois	1,976,200	19.5	38,535,900	69	26,589,771					
Michigan	1,041,600	13.1	13,644,960	72	9,824,371					
Wisconsin	62,440	18.4	1,148,896	72	827,205	225,600	15.7	3,541,920	72	2,550,182
Minnesota						5,119,412	10.9	55,801,591	65	36,271,034
Iowa	65,660	22.3	1,464,218	64	937,100	520,000	14.9	7,748,000	64	4,958,720
Missouri	2,144,250	14.8	31,734,900	67	21,262,383					
North Dakota						5,992,000	13.0	77,896,000	63	49,074,480
South Dakota						3,131,000	13.4	41,955,400	61	25,592,794
Nebraska	2,041,560	23.2	47,364,192	57	26,997,589	335,000	14.7	4,924,500	57	2,806,965
Kansas	5,131,800	15.3	78,516,540	58	45,539,593	290,708	11.4	3,314,071	58	1,922,161
Kentucky	818,624	14.1	11,542,598	73	8,426,097					
Tennessee	871,418	12.5	10,892,725	78	8,496,326					
Alabama	98,639	11.0	1,085,029	94	1,019,927					
Mississippi	1,761	10.0	17,610	87	15,321					
Texas	1,228,364	11.5	14,126,186	77	10,877,163					
Indian Territory	240,849	12.0	2,890,188	62	1,791,917					
Oklahoma	1,333,133	14.0	18,663,862	55	10,265,124					
Arkansas	177,338	10.8	1,915,250	75	1,436,438					
Montana						137,389	24.0	3,297,336	64	2,110,295
Wyoming						30,352	28.7	871,102	73	635,904
Colorado						254,355	32.5	8,266,538	65	5,373,250
New Mexico						44,826	25.0	1,120,650	83	930,140
Arizona						15,542	25.2	391,658	103	403,408
Utah						178,417	27.4	4,888,626	65	3,177,607
Nevada						27,604	31.5	869,526	85	739,097
Idaho	167,545	25.4	4,255,643	60	2,553,386	169,191	23.5	3,975,988	60	2,385,593
Washington	327,315	24.1	7,888,292	62	4,890,741	876,886	19.6	17,186,966	62	10,655,919
Oregon	364,251	22.3	8,122,797	66	5,361,046	348,160	17.5	6,092,800	67	4,082,176
California	1,572,144	17.1	26,883,662	75	20,162,746					
United States	29,599,961	16.7	492,888,004	68.3	336,435,081	17,705,868	13.7	242,372,966	63.5	153,897,679

Average yield of wheat in certain countries, in bushels per acre, 1896–1905.

Year.	United States.	Russia.	Germany.	Austria.	Hungary.	France.	United Kingdom.
	(a)	(b)	(b)	(b)	(b)	(a)	(a)
1896	12.4	9.0	26.4	15.9	19.4	20.0	34.7
1897	13.4	7.3	25.3	13.2	11.7	15.1	30.0
1898	15.3	9.8	27.2	18.0	17.1	21.1	35.8
1899	12.3	9.1	28.4	18.9	17.8	21.2	33.8
1900	12.3	8.1	27.9	15.5	16.9	19.2	29.5
1901	15.0	7.9	23.5	16.7	15.1	18.5	31.9
1902	14.5	11.1	30.3	19.0	20.7	20.2	33.9
1903	12.9	10.6	29.3	17.7	19.0	22.8	31.1
1904	12.5	11.5	29.4	19.5	16.3	19.3	27.8
1905	14.5	10.2	28.6	19.6	18.4	20.8	33.9
Average	13.5	9.5	27.6	17.4	17.2	19.8	32.2

[a] Winchester bushels. [b] Bushels of 60 pounds.

Average yield per acre of wheat in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	16.5	19.5	22.5	19.5	23.9	25.3	25.5	23.3	23.0	24.8
New Hampshire	16.0	19.0	17.2	16.3	......	......	......	......	......	......
Vermont	17.0	22.5	22.0	23.5	18.7	18.8	20.9	25.1	18.8	22.3
Connecticut	20.0	20.0	18.3	20.8	......	......	......	......	......	......
New York	21.4	21.2	18.5	17.7	13.1	16.8	17.8	11.3	21.0	20.0
New Jersey	18.5	17.4	14.5	19.1	16.8	16.0	14.0	13.3	16.4	18.3
Pennsylvania	19.7	17.5	13.6	13.5	17.1	15.8	15.6	14.1	17.1	17.7
Delaware	21.5	13.3	12.8	20.3	18.5	16.5	10.2	14.9	13.8	16.0
Maryland	19.2	15.3	14.1	19.5	17.2	14.7	12.5	13.4	16.3	16.0
Virginia	12.0	14.1	8.4	11.9	10.9	5.7	8.7	10.2	11.4	12.5
West Virginia	13.4	13.8	9.3	9.8	10.9	7.7	10.2	10.1	12.3	12.7
North Carolina	8.0	9.2	6.7	9.6	8.7	5.3	5.1	8.6	6.7	9.1
South Carolina	8.7	10.6	6.5	9.0	8.8	5.6	6.5	8.1	6.1	9.3
Georgia	9.4	10.0	6.8	9.1	8.2	6.0	6.2	8.8	6.9	10.0
Ohio	16.9	16.9	14.2	6.0	15.3	17.1	13.7	11.5	17.1	20.4
Indiana	13.0	15.6	9.8	5.3	15.8	16.0	10.0	9.2	18.3	20.7
Illinois	7.9	11.0	10.0	13.0	17.6	17.9	8.4	15.8	16.0	19.5
Michigan	15.6	20.8	8.4	7.6	11.1	17.7	15.5	9.8	18.5	13.1
Wisconsin	12.5	18.0	15.5	15.5	16.1	18.1	15.6	15.5	16.6	16.3
Minnesota	13.0	15.8	13.4	10.5	12.9	13.9	13.1	12.8	13.3	10.9
Iowa	13.0	16.7	13.0	15.6	16.2	12.7	12.4	11.6	14.2	15.7
Missouri	9.0	9.8	9.9	12.5	15.9	19.9	8.7	17.7	12.4	14.8
North Dakota	10.3	14.4	12.8	4.9	13.1	15.9	12.7	11.8	14.0	13.0
South Dakota	8.0	12.4	10.7	6.9	12.9	12.2	13.8	9.6	13.7	13.4
Nebraska	14.5	16.4	10.3	12.0	17.1	20.9	15.7	13.6	19.4	22.0
Kansas	15.5	14.2	9.8	17.7	18.5	10.4	14.1	12.4	13.9	15.1
Kentucky	13.6	15.4	9.1	13.0	12.1	9.3	8.4	11.4	11.3	14.1
Tennessee	11.2	13.2	8.7	9.9	10.8	7.2	7.1	11.5	7.2	12.5
Alabama	10.0	12.0	7.6	9.5	8.7	6.0	9.1	10.3	9.6	11.0
Mississippi	10.0	13.9	7.7	9.6	8.8	8.0	8.0	8.8	10.8	10.0
Texas	15.8	14.8	11.1	18.4	8.9	9.0	13.4	10.7	8.9	11.5
Indian Territory	......	......	......	......	12.2	12.3	12.0	14.1	10.0	12.0
Oklahoma	19.0	14.9	13.3	19.0	16.4	11.1	14.9	11.7	8.2	14.0
Arkansas	10.5	11.0	8.6	10.1	8.8	9.1	7.0	10.1	7.9	10.8
Montana	32.5	29.5	25.7	26.6	26.5	26.0	28.2	23.9	23.8	24.0
Wyoming	25.0	23.7	18.8	17.6	24.5	23.5	20.9	22.1	25.4	28.7
Colorado	24.0	26.3	23.7	22.6	24.1	18.0	26.6	22.8	25.0	32.5
New Mexico	24.0	23.8	13.8	21.0	21.5	17.1	18.4	12.8	22.2	25.0
Arizona	18.0	31.7	15.3	14.6	21.8	18.7	25.3	25.5	24.4	25.2
Utah	21.0	28.0	20.7	20.9	20.5	21.2	22.6	26.6	26.4	27.4
Nevada	24.3	29.0	18.0	24.5	25.1	27.1	27.6	26.2	27.0	31.5
Idaho	22.0	31.0	24.2	20.8	21.2	22.1	21.1	22.9	28.2	24.4
Washington	23.5	24.2	22.7	23.5	29.1	22.2	20.3	22.2	24.6	20.8
Oregon	17.0	20.5	19.2	13.8	21.1	20.9	18.2	19.0	18.6	20.0
California	10.0	9.1	14.1	10.3	13.0	10.9	11.2	10.8	9.3	17.1
General average	13.4	15.3	12.3	12.3	15.0	14.5	12.9	12.5	14.5	15.5

Average value per acre of wheat in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$17.49	$17.36	$20.47	$17.55	$23.18	$25.28	$24.99	$24.23	$24.38	$25.05
New Hampshire	17.60	17.48	16.34	15.00	......	......	......	......	......	......
Vermont	17.68	20.25	18.70	18.33	17.58	20.49	19.85	28.36	16.92	19.18
Connecticut	20.00	17.00	17.39	17.05	......	......	......	......	......	......
New York	19.26	15.26	14.80	13.63	10.74	13.27	14.42	12.32	18.06	16.40
New Jersey	17.20	12.70	10.88	14.13	12.10	12.16	11.48	14.63	14.43	14.64
Pennsylvania	17.93	11.90	8.98	9.72	12.31	11.53	12.32	15.23	14.88	13.45
Delaware	20.21	9.18	8.70	14.21	13.13	12.38	7.96	16.09	11.32	11.36
Maryland	17.86	10.71	9.59	13.84	12.21	10.58	9.58	14.20	13.37	11.36
Virginia	11.04	9.31	5.80	8.57	7.96	4.50	7.31	11.12	10.03	10.12
West Virginia	11.93	9.80	6.60	7.55	8.39	6.31	8.67	11.01	10.95	10.29
North Carolina	7.52	7.18	5.49	7.87	7.13	4.88	4.95	10.23	6.83	8.46
South Carolina	10.27	9.96	6.44	9.09	8.62	5.71	6.56	10.21	6.77	10.23
Georgia	9.68	9.80	6.66	8.64	7.71	5.88	5.95	11.09	7.38	10.20
Ohio	14.87	11.15	9.09	4.26	10.86	12.14	10.96	12.65	14.02	14.48
Indiana	11.57	9.83	6.27	3.71	11.06	10.88	7.80	9.75	15.01	14.49
Illinois	7.03	6.00	6.30	8.32	12.14	10.56	6.30	13.94	12.96	13.46
Michigan	13.57	13.31	5.46	5.24	7.88	12.21	11.94	10.58	14.61	9.43
Wisconsin	10.50	10.62	9.46	9.92	10.48	11.61	11.22	15.18	12.65	11.73
Minnesota	10.01	8.53	7.37	6.62	7.74	8.48	9.04	11.14	9.44	7.08
Iowa	9.75	8.68	7.15	9.20	9.75	6.96	7.69	10.48	10.08	10.07
Missouri	7.65	5.78	6.14	7.88	10.97	11.54	6.18	11.23	9.80	9.92
North Dakota	7.62	7.34	6.53	2.84	7.07	9.22	8.00	9.56	9.66	8.19
South Dakota	5.52	6.20	5.35	4.00	6.84	6.95	8.56	7.58	9.18	8.17
Nebraska	10.60	7.71	5.65	6.36	9.23	10.23	8.47	11.83	12.81	12.54

Average value per acre of wheat in the United States, based upon farm value December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Kansas	$11.47	$7.10	$5.10	$9.73	$10.92	$5.73	$8.33	$11.06	$9.88	$8.75
Kentucky	12.10	9.53	6.01	8.97	8.71	6.88	6.80	12.43	9.83	10.29
Tennessee	10.64	8.84	6.79	7.82	7.99	5.47	5.96	12.77	6.55	9.75
Alabama	10.10	10.80	6.76	8.45	7.66	5.58	8.65	11.85	9.70	10.34
Mississippi	9.90	11.54	6.01	8.06	7.57	6.80	7.44	8.89	10.26	8.70
Texas	14.06	10.06	7.55	11.78	6.94	6.93	10.45	11.77	7.83	8.85
Indian Territory	......	......	......	......	8.42	7.50	8.28	13.82	7.70	7.44
Oklahoma	14.44	7.75	7.05	10.07	10.33	6.44	9.39	10.88	5.66	7.70
Arkansas	8.82	6.38	5.50	6.57	6.86	6.10	5.46	10.20	7.11	8.10
Montana	22.10	17.11	15.68	16.23	17.76	16.12	18.61	21.28	16.90	15.36
Wyoming	17.50	16.35	12.60	13.38	16.91	19.04	15.47	19.89	18.29	20.95
Colorado	16.80	14.73	13.51	13.33	16.15	13.50	17.56	22.75	17.50	21.13
New Mexico	18.00	14.76	8.42	14.28	15.48	14.71	13.80	13.57	19.98	20.75
Arizona	13.32	29.16	9.79	11.53	18.53	19.64	23.53	28.82	26.21	25.96
Utah	14.28	15.12	10.97	11.49	14.35	16.11	18.08	22.88	17.09	17.81
Nevada	21.87	27.55	13.68	17.15	22.09	25.56	27.32	24.10	20.79	26.77
Idaho	15.40	15.81	12.10	9.57	12.93	15.44	15.86	18.34	18.49	14.66
Washington	15.98	13.07	11.58	11.99	13.67	14.44	14.04	17.77	16.13	12.91
Oregon	12.24	12.71	10.18	7.59	11.37	13.37	13.98	15.37	12.68	13.26
California	8.30	6.55	8.74	5.97	7.80	8.72	9.74	9.50	7.63	12.82
General average	10.86	8.92	7.17	7.61	9.37	9.14	8.96	11.58	10.83	10.37

Average farm price of wheat per bushel in the United States, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$1.06	$0.89	$0.91	$0.90	$0.97	$0.92	$0.98	$1.04	$1.06	$1.01
New Hampshire	1.10	.92	.95	.92	......	......	......	......	......	......
Vermont	1.04	.90	.85	.78	.94	1.09	.95	1.13	.90	.86
Connecticut	1.00	.88	.95	.82	......	......	......	......	......	......
New York	.90	.72	.80	.77	.82	.79	.81	1.09	.86	.82
New Jersey	.93	.73	.75	.74	.72	.76	.82	1.10	.88	.80
Pennsylvania	.91	.68	.66	.72	.72	.73	.79	1.08	.87	.76
Delaware	.94	.69	.68	.70	.71	.75	.78	1.08	.82	.71
Maryland	.93	.70	.68	.71	.71	.72	.79	1.06	.82	.71
Virginia	.92	.66	.69	.72	.73	.79	.84	1.09	.88	.81
West Virginia	.89	.71	.71	.77	.77	.82	.85	1.09	.89	.81
North Carolina	.94	.78	.82	.82	.82	.92	.97	1.19	1.02	.93
South Carolina	1.18	.94	.99	1.01	.98	1.02	1.01	1.26	1.11	1.10
Georgia	1.03	.98	.98	.95	.94	.98	.96	1.26	1.07	1.02
Ohio	.88	.66	.64	.71	.71	.71	.80	1.10	.82	.71
Indiana	.89	.63	.64	.70	.70	.68	.78	1.06	.82	.70
Illinois	.89	.60	.63	.64	.69	.59	.75	1.01	.81	.69
Michigan	.87	.64	.65	.69	.71	.69	.77	1.08	.79	.72
Wisconsin	.84	.59	.61	.64	.65	.64	.72	.98	.76	.72
Minnesota	.77	.54	.55	.63	.60	.61	.69	.87	.71	.65
Iowa	.75	.52	.55	.59	.60	.55	.62	.90	.71	.64
Missouri	.85	.59	.62	.63	.69	.58	.71	.96	.79	.67
North Dakota	.74	.51	.51	.58	.54	.58	.63	.81	.69	.63
South Dakota	.69	.50	.50	.58	.53	.57	.62	.79	.67	.61
Nebraska	.69	.47	.49	.53	.54	.49	.54	.87	.66	.57
Kansas	.74	.50	.52	.55	.59	.55	.59	.89	.71	.58
Kentucky	.89	.62	.66	.69	.72	.74	.81	1.09	.87	.73
Tennessee	.95	.67	.78	.79	.74	.76	.84	1.11	.91	.78
Alabama	1.01	.90	.89	.89	.88	.93	.95	1.15	1.01	.94
Mississippi	.99	.83	.78	.84	.86	.85	.93	1.01	.95	.87
Texas	.89	.68	.68	.64	.78	.77	.78	1.10	.88	.77
Indian Territory	......	......	......	......	.69	.61	.69	.98	.77	.62
Oklahoma	.76	.52	.53	.53	.63	.58	.63	.93	.69	.55
Arkansas	.84	.58	.64	.65	.78	.67	.78	1.01	.90	.75
Montana	.68	.58	.61	.61	.67	.62	.66	.89	.71	.64
Wyoming	.70	.69	.67	.76	.69	.81	.74	.90	.72	.73
Colorado	.70	.56	.57	.59	.67	.75	.66	.91	.70	.65
New Mexico	.75	.62	.61	.68	.72	.86	.75	1.06	.90	.83
Arizona	.74	.92	.64	.79	.85	1.05	.93	1.13	1.17	1.03
Utah	.68	.54	.53	.55	.70	.76	.80	.86	.67	.65
Nevada	.90	.95	.76	.70	.88	.98	.99	.92	.77	.85
Idaho	.70	.51	.50	.46	.61	.70	.75	.80	.66	.60
Washington	.68	.54	.51	.51	.47	.65	.69	.80	.65	.62
Oregon	.72	.62	.53	.55	.54	.67	.77	.81	.68	.66
California	.83	.72	.62	.58	.60	.80	.87	.88	.82	.75
General average	.808	.582	.584	.619	.624	.630	.695	.924	.748	.667

Wholesale prices of wheat per bushel in leading cities of the United States, 1901–1906.

Date.	New York.		Baltimore.		Chicago.		Detroit.		St. Louis.		Minneapolis.		San Francisco.	
	No. 2, red winter.		Southern, No. 2, red.		No. 1, northern spring.		No. 2, red.		No. 2, red winter.		No. 1, northern.		No. 1, California (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1901.														
January	$0.79⅛	$0.83⅛	$0.73¾	$0.78	$0.71⅜	$0.76⅜	$0.78	$0.82½	$0.72	$0.77	$0.73	$0.77½	$0.97½	$1.01¼
February	.79¾	.81¼	.76	.78¾	.72⅛	.74¾	.78½	.80¼	.73½	.75¾	.73	.74⅜	.95	.98¾
March	.80⅛	.82¼	.77¾	.81	.73¼	.76¼	.78½	.80	.74	.75¾	.73	.74⅝	.95	1.02½
April	.78⅜	.84¾	.76½	.81½	.69½	.74⅞	.74	.78	.71	.76¼	.70¼	.74½	1.00	1.05
May	.81¾	.84⅞	.78¼	.80½	.70	.75½	.74½	.77¼	.73½	.76	.70⅞	.74¼	.97½	1.01¼
June	.75½	.85¼	.72	.79½	.65½	.77¼	.67¾	.77¼	.63¾	.75½	.62⅞	.74¾	.96¼	1.00
July	.72¾	.79¾	.69¼	.75½	.63⅛	.71¾	.66½	.74	.61¼	.70¾	.60½	.69¾	.95	1.00
August	.76	.80½	.72	.78	.66⅝	.77	.68¼	.76½	.66¼	.73⅞	.66	.71½	.97½	.98¾
September	.75⅜	.77⅜	.78½	.75½	.68⅛	.71	.70½	.73½	.70⅜	.72½	.66¾	.69⅛	.96¼	.97½
October	.74⅝	.80⅝	.70½	.75	.66¾	.71½	.70	.74	.70½	.73½	.66	.68⅞	.95	.98¾
November	.80⅛	.83⅛	.74¼	.78	.70	.73¾	.73	.79½	.72¼	.80	.68⅛	.71½	.98⅜	1.01¼
December	.84¾	.89⅞	.78½	.85¾	.73	.79½	.79	.90½	.81	.88½	.71¾	.77	1.01¼	1.06¼
1902.														
January	.85¾	.94¼	.81⅜	.87½	.74	.80½	.86	.93½	.86½	.92½	.73⅝	.79½	1.05	1.08¾
February	.85⅞	.93¼	.80	.85⅝	.72⅞	.76½	.84¼	.87½	.83¼	.89	.72¼	.75⅛	1.07½	1.12½
March	.82	.90⅜	.76	.85	.69¾	.76	.77½	.85¾	.76⅜	.86¾	.70½	.75⅛	1.10	1.12½
April	.82	.92½	.75	.85½	.70	.76¾	.77½	.87¼	.77¼	.83½	.70⅝	.77⅜	1.10	1.13¾
May	.88¼	.93¾	.81	.87½	.72⅜	.76¼	.80	.88	.76½	.84½	.74	.78	1.11¼	1.16¼
June	.87⅜	.93⅜	.76	.83	.71¼	.75¾	.79	.81½	.76	.80	.73⅛	.77½	1.11¼	1.13¾
July	.76⅞	.92¼	.70¾	.81¾	.71½	.79	.72	.82	.65½	.78	.76⅜	.80⅜	1.13¾	1.16¼
August	.74⅞	.78⅜	.66¼	.74¼	.68¼	.76	.68½	.73	.63	.68¼	.74¼	.79¾	1.12½	1.15
September	.73½	.77	.68	.72¾	.70	.95	.70¾	.74	.66	.68½	.66½	.71¼	1.12½	1.20
October	.73⅞	.79	.69	.75½	.67½	.75½	.72	.76¾	.67¾	.72	.68	.73⅞	1.18¾	1.35
November	.76	.79⅞	.71¼	.77½	.69⅞	.77⅜	75½	.80¾	.69	.71	.71⅞	.74½	1.32½	1.45
December	.76⅛	.80⅛	.71¼	.77	.71⅞	.77¾	.77½	.83	.69	.74½	.72¼	.74⅞	1.37½	1.43¾
1903.														
January	.78¼	.84⅝	.77½	.83	.70¾	.79¼	.77¾	.83½	.73½	.76½	.73⅛	.78⅛	1.36¼	1.50
February	.81⅝	.84	.80	.81	.73¾	.80½	.79	.81	.73½	.77½	.75⅞	.78	1.43¾	1.55
March	.78½	.83⅛	.77¾	.81	.70¼	.75⅞	.74¼	.79	.70	.75½	.74⅜	.77⅞	1.35	1.52½
April	.79	.86½	.78¼	.83	.71⅝	.79	.75¼	.77¾	.69½	.73⅝	.74⅞	.77⅜	1.35	1.38¾
May	.81¾	.89⅝	.79	.82½	.74¾	.80⅝	.76	.79½	.72	.76½	.76	.80⅛	1.32½	1.40
June	.85	.87	.78¼	.82	.74¼	.85⅞	.77¾	.82	.76	.83¼	.79½	.88⅛	1.32½	1.40
July	.80¼	.89⅜	.76½	.81	.75	.84	.76½	.80	.77½	.82	.83¼	.89¼	1.32½	1.50
August	.83¾	.89⅞	.79	.83½	.77¼	.90¼	.78½	.84	.79¼	.85	.83⅜	1.00	1.45	1.50
September	.81¾	.89½	.78¼	.83¼	.79½	.93	.79	.84¼	.84	.88	.82	.91¾	1.37½	1.47½
October	.82⅛	.91⅝	.80½	.86	.76¾	.88	.82¾	.87½	.85	.89	.78¼	.86	1.36¼	1.41¼
November	.83¾	.92⅜	.82½	.87	.75¾	.86¼	.84	.90	.85½	.90½	.77⅜	.82⅛	1.38¾	1.41¼
December	.89⅛	.99⅞	.85¾	.88¾	.77¾	.87	.89½	.94	.90	.94	.80½	.83⅞	1.33¾	1.40
1904.														
January	.92½	1.01	.88¼	.94	.81¼	.93½	.92	.95½	.89½	.97	.84¾	.91¼	1.35	1.40
February	.94	1.15	.94	1.12	.86	1.10	.94¼	1.12	.94	1.12	.90	1.05	1.35	1.43¾
March	1.01	1.11	.99	1.05¼	.88¼	.98⅜	.97½	1.04½	.98	1.08½	.94⅛	1.01½	1.36¼	1.43¾
April	1.04	1.10½	.98½	1.05	.85½	.96⅞	.98	1.05	.97	1.08	.90⅞	.98¾	1.27½	1.40
May	1.06	1.20	.99½	1.08	.87¾	1.01½	1.02½	1.12½	.98	1.10	.93½	.98⅝	1.26¼	1.30
June	1.04	1.15½	.82	1.03¼	.92	1.00	1.01	1.13	1.00	1.10¾	.93½	.97½	1.23¾	1.30
July	1.00	1.16	.82	.89	.94½	1.06½	.97	1.07	.91	1.12	.94⅜	1.02	1.23¾	1.37½
August	1.00	1.20¾	.88⅜	1.09¼	1.02	1.20	.98	1.16	.91	1.14¼	1.03½	1.24⅜	1.37½	1.46¼
September	1.08	1.25¼	1.03¼	1.14	1.16	1.22	1.11½	1.23	1.08½	1.21	1.12	1.24½	1.40	1.48¾
October	1.13½	1.26¼	1.13	1.18½	1.15	1.22	1.16	1.21	1.13½	1.21	1.11⅝	1.22	1.45	1.50
November	1.17¼	1.25¾	1.08½	1.15¼	1.15	1.20	1.16	1.22	1.12½	1.18	1.06⅜	1.19⅝	1.45	1.50
December	1.16	1.24¼	1.08¾	1.15	1.15	1.22	1.15	1.20	1.13	1.18½	1.06⅛	1.14½	1.45	1.50
1905.														
January	1.18⅞	1.25¾	1.01¾	1.19½	1.18	1.21	1.19	1.23½	1.14	1.20	1.08½	1.13½	1.45	1.52½
February	1.20¼	1.25¼	1.01½	1.17½	1.15	1.24	1.17½	1.24	1.16½	1.19½	1.07¾	1.12¾	1.50	1.55
March	1.14⅛	1.21⅜	.98	1.14½	1.12	1.18¾	1.07½	1.21	1.11½	1.17	1.05	1.11⅞	1.50	1.55
April	.91½	1.15	.83	1.09½	.88½	1.18	.96	1.07½	.98	1.12	.91⅝	1.08⅛	1.45	1.55
May	.91½	1.11½	.83½	1.07½	.89½	1.13¾	.97	1.08	.95	1.13½	.95⅝	1.24½	1.45	1.55
June	1.03⅜	1.14¼	.73	1.03½	1.07⅜	1.20	1.00	1.09	.92	1.06	1.04	1.09¼	1.50	1.55
July	.90	1.09¼	.75	.92	1.12	1.20	.86	1.05	.83½	.95½	1.01¼	1.09¼	1.50	1.55
August	.84⅜	.91⅛	.76	.84½	1.03	1.15	.81	.84	.82½	.88	.83½	1.11	1.45	1.55
September	.85⅝	.91⅜	.75¾	.84½	.88	.95	.82¼	.85¾	.82	.90	.75¼	.80	1.40	1.55
October	.88¼	.99	.76½	.86½	.86	.92¼	.80	.90½	.88	.95	.78⅜	.87⅛	1.40	1.45
November	.90	.98¼	.76	.85¼	.85	.92	.87¼	.90½	.89	.95	.79	.84½	1.40	1.45
December	.92¾	1.01	.78	.87	.82½	.90	.86	.89	.92¾	1.01	.77¾	.81¾	1.35	1.45

Wholesale prices of wheat per bushel in leading cities of the United States, 1901–1906—Continued.

Date.	New York. No. 2, red winter.		Baltimore. Southern, No. 2, red.		Chicago. No. 1, northern spring.		Detroit. No. 2, red.		St. Louis. No. 2, red winter.		Minneapolis. No. 1, northern.		San Francisco. No. 1, California (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1906.														
January	.89½	.97	.84	.86¾	.81¼	.85¼	.85	.88	.92½	.96	......	......	......	......
February	.90⅜	.96½	.84½	.86¾	.79¼	.83½	.84	.86½	.88	.95½	......	......	......	......
March	.85	.89¼	.81	.84¾	.74½	.79½	.81	.86	.89	.94	......	......	......	......
April	.88¼	.92¼	.83	.88¾	.77½	.83	.85½	.89	.90	.98	......	......	......	......
May	.93	.95	.86¾	.89½	.80¼	.87¼	.89¼	.93½	.88	.98½	......	......	......	......
June	.91⅞	.97	.87¼	.91	.81⅝	.85¾	.86	.89¾	.80	.95	......	......	......	......
July	.81	.92⅜	.75¾	.81¾	.75¾	.84	.74¾	.85½	.71¾	.82	......	......	......	......
August	.77¼	.81½	.71	.75	.73⅝	.77⅞	.72¼	.75	.68⅛	.72½	......	......	......	......
September	.77	.81	.68	.74⅛	.77	.79	.72	.75¼	.69	.75½	......	......	......	......
October	.78½	.83⅛	.74	.75⅜	a.71	a.73¾	.74¾	.78¼	.74	.77½	......	......	......	......
November	.80½	.84¼	.73½	.75½	a.71⅝	a.74¼	.77½	.78½	.74	.76½	......	......	......	......
December	.80¼	.83	.73⅜	.75	a.72⅝	a.75	.76⅜	.78¼	.74	.76½	......	......	......	......

a No. 2, red.

OATS.

Oat crop of countries named, 1902–1906.

[Substantially the crop of the world.]

Country.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	987,843,000	784,094,000	894,596,000	953,216,000	964,905,000
Canada:					
New Brunswick	5,481,000	5,974,000	5,316,000	5,659,000	5,875,000
Ontario	109,786,000	113,337,000	105,393,000	108,890,000	111,756,000
Manitoba	35,565,000	34,077,000	37,434,000	46,917,000	52,291,000
Saskatchewan	7,196,000	9,453,000	11,095,000	19,819,000	24,721,000
Alberta	3,896,000	5,351,000	5,786,000	9,814,000	14,209,000
Other	43,000,000	43,000,000	43,000,000	43,000,000	43,000,000
Total Canada	204,924,000	211,192,000	208,024,000	234,099,000	251,852,000
Mexico	13,000	13,000	18,000	17,000	17,000
Total North America	1,192,780,000	995,299,000	1,102,638,000	1,187,332,000	1,216,774,000
EUROPE.					
Austria-Hungary:					
Austria	125,473,000	128,330,000	109,611,000	123,880,000	154,551,000
Hungary proper	82,807,000	87,334,000	62,775,000	78,009,000	87,733,000
Croatia-Slavonia	6,301,000	7,330,000	4,907,000	6,075,000	6,200,000
Bosnia-Herzegovina	3,001,000	5,612,000	3,829,000	2,935,000	3,836,000
Total Austria-Hungary	217,582,000	228,606,000	181,122,000	210,899,000	252,320,000
Belgium	45,588,000	48,345,000	37,499,000	33,786,000	40,000,000
Bulgaria	10,000,000	11,389,000	11,179,000	10,263,000	18,793,000
Denmark	40,822,000	41,176,000	38,183,000	32,659,000	38,000,000
Finland	15,190,000	17,046,000	16,995,000	15,000,000	16,000,000
France	276,948,000	300,366,000	257,811,000	269,581,000	258,454,000
Germany	514,452,000	542,432,000	477,852,000	451,017,000	580,875,000
Italy	13,000,000	16,000,000	14,000,000	16,000,000	18,000,000
Netherlands	19,241,000	20,112,000	18,592,000	16,045,000	18,000,000
Norway	6,674,000	9,091,000	6,922,000	9,868,000	8,000,000
Roumania	21,905,000	33,108,000	12,608,000	18,974,000	26,165,000
Russia:					
Russia proper	807,888,000	650,405,000	1,006,102,000	767,550,000	544,873,000
Poland	63,167,000	58,745,000	44,393,000	61,933,000	66,424,000
Northern Caucasia	16,112,000	18,939,000	14,593,000	22,228,000	21,968,000
Total Russia (European)	887,167,000	728,089,000	1,065,088,000	851,711,000	633,265,000

Oat crop of countries named, 1902–1906—Continued.

Country.	1902.	1903.	1904.	1905.	1906.
EUROPE—continued.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Servia	4,044,000	4,398,000	3,167,000	3,549,000	4,642,000
Spain	23,349,000	22,942,000	18,500,000	22,305,000	45,632,000
Sweden	57,323,000	59,641,000	51,578,000	58,488,000	68,631,000
United Kingdom:					
Great Britain—					
England	89,809,000	85,400,000	86,728,000	76,453,000	84,102,000
Scotland	36,760,000	36,379,000	37,034,000	36,390,000	35,107,000
Wales	7,924,000	6,832,000	7,661,000	7,264,000	8,063,000
Ireland	65,570,000	58,816,000	60,142,000	60,754,000	60,000,000
Total United Kingdom	200,063,000	187,427,000	191,565,000	180,861,000	187,272,000
Total Europe	2,353,348,000	2,270,168,000	2,402,661,000	2,201,006,000	2,214,049,000
ASIA.					
Cyprus	236,000	481,000	417,000	400,000	400,000
Russia.					
Central Asia	9,433,000	11,342,000	8,014,000	14,279,000	9,806,000
Siberia	34,078,000	60,352,000	51,101,000	70,672,000	69,872,000
Total Russia (Asiatic)	43,511,000	71,694,000	59,115,000	84,951,000	79,678,000
Total Asia	43,747,000	72,175,000	59,532,000	85,351,000	80,078,000
AFRICA.					
Algeria	8,732,000	7,976,000	6,631,000	6,000,000	8,000,000
Cape of Good Hope	1,750,000	2,503,000	2,000,000	2,000,000	2,000,000
Natal	9,000	6,000	43,000	9,000	9,000
Tunis	324,000	1,631,000	4,635,000	2,032,000	2,411,000
Total Africa	10,815,000	12,116,000	13,309,000	10,041,000	12,420,000
AUSTRALASIA.					
Australia:					
Queensland	44,000	1,000	73,000	16,000	6,000
New South Wales	709,000	363,000	1,292,000	673,000	911,000
Victoria	6,937,000	4,542,000	13,858,000	6,353,000	7,460,000
South Australia	484,000	640,000	931,000	573,000	897,000
Western Australia	164,000	173,000	267,000	233,000	293,000
Tasmania	1,756,000	1,808,000	1,673,000	1,216,000	1,238,000
Total Australian Commonwealth	10,094,000	7,527,000	18,094,000	9,064,000	10,805,000
New Zealand	15,519,000	22,452,000	15,583,000	15,012,000	13,108,000
Total Australasia	25,613,000	29,979,000	33,677,000	24,076,000	23,913,000
Grand total	3,626,303,000	3,379,737,000	3,611,817,000	3,507,806,000	3,547,234,000

Visible supply of oats in the United States and Canada, first of each month, for ten years.[a]

Month.	1897–98.	1898–99.	1899–1900.	1900–1901.	1901–2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	12,912,000	8,716,000	10,262,000	12,716,000	15,275,000
August	9,604,000	4,971,000	6,885,000	9,364,000	7,808,000
September	13,784,000	7,360,000	10,973,000	13,853,000	10,603,000
October	15,573,000	9,286,000	13,127,000	17,140,000	14,445,000
November	20,096,000	11,352,000	13,254,000	20,528,000	12,899,000
December	19,768,000	9,460,000	11,789,000	18,136,000	10,109,000
January	16,148,000	10,893,000	12,004,000	15,861,000	8,680,000
February	20,245,000	13,231,000	11,876,000	16,175,000	8,537,000
March	17,925,000	14,782,000	12,449,000	16,800,000	8,207,000
April	15,609,000	15,725,000	14,176,000	15,823,000	6,606,000
May	14,402,000	13,971,000	13,845,000	16,824,000	5,010,000
June	10,421,000	13,661,000	12,301,000	14,989,000	4,571,000

[a] These figures represent stocks available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals, as reported by Bradstreet's.

Visible supply of oats in the United States and Canada, first of each month, for ten years—Continued.

Month.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	2,420,000	6,686,000	6,766,000	11,174,000	10,020,000
August	2,988,000	8,623,000	4,044,000	8,007,000	7,607,000
September	5,159,000	11,714,000	19,607,000	20,597,000	13,241,000
October	11,241,000	10,876,000	31,553,000	28,018,000	15,969,000
November	10,661,000	13,332,000	33,693,000	37,526,000	17,275,000
December	10,401,000	13,995,000	34,103,000	40,206,000	20,011,000
January	8,794,000	13,785,000	31,343,000	39,301,000	19,766,000
February	8,727,000	14,774,000	26,095,000	35,791,000	18,034,000
March	12,437,000	15,241,000	22,570,000	31,726,000	15,664,000
April	12,432,000	15,377,000	22,667,000	28,006,000	14,435,000
May	9,992,000	12,955,000	19,395,000	22,033,000	14,815,000
June	7,160,000	8,296,000	11,325,000	12,785,000	....

Condition of the oat crop of the United States, monthly, 1889–1906.

Year.	June.	July.	August.	September.	Year.	June.	July.	August.	September.	Year.	June.	July.	August.	September.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1889	93.8	94.1	92.3	90.0	1895	84.3	83.2	84.5	86.0	1901	85.3	83.7	73.6	72.1
1890	89.8	81.6	70.1	64.4	1896	98.8	96.3	77.3	74.0	1902	90.6	92.1	89.4	87.2
1891	85.1	87.6	89.5	90.7	1897	89.0	87.5	86.0	84.6	1903	85.5	84.3	79.5	75.7
1892	88.5	87.2	86.2	78.9	1898	98.0	92.8	84.2	79.0	1904	89.2	89.8	86.6	85.6
1893	88.9	88.8	78.3	74.9	1899	88.7	90.0	90.8	87.2	1905	92.9	92.1	90.8	90.3
1894	87.0	77.7	76.5	77.8	1900	91.7	85.5	85.0	82.9	1906	85.9	84.0	82.8	81.9

Acreage, production, value, prices, exports, etc., of oats of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel, No. 2.				Domestic exports, including oatmeal, fiscal year beginning July 1.[a]	Imports during fiscal year beginning July 1.[a]
						December.		May of following year.			
						Low.	High.	Low.	High.		
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1866	8,864,219	30.2	268,141,077	35.1	94,057,945	36	43	59	78	825,895	778,198
1867	10,746,416	25.9	278,698,000	44.5	123,902,556	52	57¼	......	......	122,554	780,798
1868	9,665,736	26.4	254,960,800	41.7	106,355,976	43	49½	56¾	62½	481,871	326,659
1869	9,461,441	30.5	288,334,000	38.0	109,521,734	40	44¾	46½	53½	121,517	2,266,785
1870	8,792,395	28.1	247,277,400	39.0	96,443,637	37¾	41	47¼	51	147,572	599,514
1871	8,365,809	30.6	255,743,000	36.2	92,591,359	30¾	33	34¾	42½	262,975	535,250
1872	9,000,769	30.2	271,747,000	29.9	81,303,518	23½	25¾	30	34	714,072	225,555
1873	9,751,700	27.7	270,340,000	34.6	93,474,161	34	40⅝	44	48½	812,873	191,802
1874	10,897,412	22.1	240,369,000	47.1	113,133,934	51¾	54½	57¼	64½	504,770	1,500,040
1875	11,915,075	29.7	354,317,500	32.0	113,441,491	29½	30½	28⅝	31½	1,466,228	121,547
1876	13,358,908	24.0	320,884,000	32.4	103,844,896	31¾	34½	37¼	45¾	2,854,128	41,597
1877	12,826,148	31.7	406,394,000	28.4	115,546,194	24⅛	27	23	27	3,715,479	21,391
1878	13,176,500	31.4	413,578,560	24.6	101,752,468	19⅝	20⅜	24⅜	30½	5,452,136	13,395
1879	12,683,500	28.7	363,761,320	33.1	120,533,294	32¾	36¾	29½	34⅞	766,366	489,576
1880	16,187,977	25.8	417,885,380	36.0	150,243,565	29⅛	33½	36¼	39½	402,904	64,412
1881	16,831,600	24.7	416,481,000	46.4	193,198,970	43½	46¾	48¾	56⅜	625,690	1,850,983
1882	18,494,691	26.4	488,250,610	37.5	182,978,022	34¾	41½	38¾	42¾	461,496	815,017
1883	20,324,962	28.1	571,302,400	32.7	187,040,264	29⅜	36⅛	30¾	34¼	3,274,622	121,069
1884	21,300,917	27.4	583,628,000	27.7	161,528,470	22½	25¼	34½	37	6,203,104	94,310
1885	22,783,630	27.6	629,409,000	28.5	179,631,860	27	29	26¼	29⅝	7,311,306	149,480
1886	23,658,474	26.4	624,134,000	29.8	186,137,930	25¾	27¼	25⅛	27½	1,374,635	139,575
1887	25,920,906	25.4	659,618,000	30.4	200,699,790	28⅝	30⅞	32½	38	573,080	123,817
1888	26,998,282	26.0	701,735,000	27.8	195,424,240	25	26⅞	21⅝	23⅝	1,191,471	131,501
1889	27,462,316	27.4	751,515,000	22.9	171,781,008	20	21	24¾	30	15,107,238	153,232
1890	26,431,369	19.8	523,621,000	42.4	222,048,486	39⅞	43⅞	45¼	54	1,382,836	41,848
1891	25,581,861	28.9	738,394,000	31.5	232,312,267	31⅛	33⅝	28⅛	33½	10,586,644	47,782
1892	27,063,835	24.4	661,035,000	31.7	209,253,611	25⅝	31¼	28¾	32¼	2,700,793	49,433
1893	27,273,033	23.4	638,854,850	29.4	187,576,092	27½	29⅛	32½	36	6,290,229	31,759
1894	27,023,553	24.5	662,036,928	32.4	214,816,920	28¾	29⅜	27½	30¾	1,708,824	330,318
1895	27,878,406	29.6	824,443,537	19.9	163,655,068	16⅝	17½	18	19⅜	15,156,618	66,602

[a] In years 1866 to 1882, inclusive, oatmeal is not included.

Acreage, production, value, prices, exports, etc., of oats of the United States, 1866–1906—Continued.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, including oatmeal, fiscal year beginning July 1.	Imports during fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1896	27,565,985	25.7	707,346,404	18.7	132,485,033	16½	18¾	16⅞	18¾	37,725,083	131,204
1897	25,730,375	27.2	698,767,809	21.2	147,974,719	21	23½	26	32	73,880,307	25,093
1898	25,777,110	28.4	730,906,643	25.5	186,405,364	26	27¾	24	27¾	33,534,362	28,098
1899	26,341,380	30.2	796,177,713	24.9	198,167,975	22¼	23	21¼	23¾	45,048,857	54,576
1900	27,364,795	29.6	809,125,989	25.8	208,669,233	21¾	22¾	27⅞	31	42,268,931	32,107
1901	28,541,476	25.8	736,808,724	39.9	293,658,777	42	48¾	41	49½	13,277,612	38,978
1902	28,653,144	34.5	987,842,712	30.7	303,584,852	29¼	32	33¾	38¼	8,381,805	150,065
1903	27,638,126	28.4	784,094,199	34.1	267,661,665	34¼	38	39⅝	44¾	1,960,740	183,983
1904	27,842,669	32.1	894,595,552	31.3	279,900,013	28¼	32	28⅝	32	8,394,692	55,099
1905	28,046,746	34.0	953,216,197	29.1	277,047,537	29½	32¾	32⅛	34¾	48,434,541	40,025
1906	30,958,768	31.2	964,904,522	31.7	306,292,978	33	35¾	......	......	....	....

Acreage, production, value, and distribution of oats in the United States in 1906, by States.

State or Territory.	Crop of 1906. Acreage.	Crop of 1906. Production.	Crop of 1906. Value.	Stock in farmers' hands March 1, 1907.		Shipped out of county where grown.
	Acres.	*Bushels.*	*Dollars.*	*Bushels.*	*Per cent.*	*Bushels.*
Maine	112,817	4,038,849	1,777,094	1,494,374	37	80,777
New Hampshire	12,296	424,212	186,653	118,779	28	0
Vermont	76,955	2,862,726	1,230,972	1,173,718	41	0
Massachusetts	6,308	214,472	94,368	77,210	36	2,145
Rhode Island	1,604	46,997	21,149	14,569	31	0
Connecticut	9,976	341,179	143,295	95,530	28	3,412
New York	1,245,628	40,233,784	16,093,514	19,714,554	49	2,816,365
New Jersey	62,512	1,662,819	681,871	798,153	48	182,910
Pennsylvania	1,161,186	31,816,496	12,090,268	13,999,258	44	1,590,825
Delaware	3,918	95,991	38,477	32,637	34	10,559
Maryland	31,834	808,584	307,262	283,004	35	72,773
Virginia	158,813	2,858,634	1,229,213	914,763	32	114,345
West Virginia	102,000	2,101,200	840,480	819,468	39	63,036
North Carolina	195,662	3,169,724	1,553,165	665,642	21	63,394
South Carolina	191,259	3,538,292	2,016,826	566,127	16	70,766
Georgia	216,922	3,362,291	1,882,883	504,344	15	67,246
Florida	28,160	394,240	268,083	39,424	10	7,885
Ohio	1,475,000	48,380,000	15,965,400	18,384,400	38	15,062,600
Indiana	1,780,000	50,198,000	16,062,720	15,058,800	30	20,078,400
Illinois	3,650,000	107,763,500	33,406,685	37,717,225	35	49,571,210
Michigan	1,425,000	43,747,500	14,436,675	17,499,000	40	10,499,400
Wisconsin	2,450,000	91,630,000	28,405,300	39,400,900	43	14,660,800
Minnesota	2,215,728	72,011,160	19,443,013	30,964,799	43	25,203,906
Iowa	4,165,000	140,777,000	38,009,790	60,534,110	43	45,048,640
Missouri	644,161	14,685,503	4,846,216	5,580,491	38	1,468,550
North Dakota	1,245,711	40,485,608	10,931,114	21,457,372	53	7,692,266
South Dakota	1,275,000	46,410,000	11,602,500	22,740,900	49	13,923,000
Nebraska	2,450,000	72,275,000	18,791,500	32,523,750	45	29,632,750
Kansas	1,050,000	24,780,000	7,681,800	9,664,200	39	3,717,000
Kentucky	208,063	4,430,354	1,683,535	1,329,106	30	265,821
Tennessee	146,573	3,151,320	1,292,041	882,370	28	315,132
Alabama	184,179	3,167,879	1,615,618	538,539	17	31,679
Mississippi	90,374	1,626,732	797,099	292,812	18	16,267
Louisiana	28,269	486,227	218,802	72,934	15	9
Texas	914,440	31,822,512	13,047,230	6,364,502	20	7,955,628
Indian Territory	217,736	7,446,571	2,382,903	2,233,971	30	1,414,848
Oklahoma	350,000	12,040,000	3,371,200	4,334,400	36	3,491,600
Arkansas	184,571	3,788,706	1,589,157	945,926	25	75,674
Montana	196,802	8,501,846	3,740,812	3,230,701	38	1,870,406
Wyoming	50,193	1,979,068	791,627	514,558	26	59,372
Colorado	147,584	5,962,394	2,683,077	2,384,958	40	1,490,598
New Mexico	12,269	424,507	220,744	106,127	25	16,980
Arizona	914	31,442	20,437	8,175	26	6,288
Utah	47,000	2,053,900	924,255	718,865	35	205,390
Nevada	6,518	252,898	161,855	63,224	25	25,290
Idaho	107,864	4,390,065	1,887,728	1,756,026	40	1,580,423
Washington	172,767	7,463,534	3,060,049	2,089,790	28	2,985,414
Oregon	284,660	9,621,508	4,137,248	2,982,667	31	3,175,098
California	163,692	5,156,298	2,681,275	773,445	15	1,495,326
United States	30,958,768	964,904,522	306,292,978	384,460,597	39.8	266,182,194

Average yield of oats in certain countries, in bushels per acre, 1896–1905.

Year.	United States.	Russia.	Germany.	Austria.	Hungary.	France.	United Kingdom.
	(a)	(b)	(b)	(b)	(b)	(a)	(a)
1896	25.7	19.2	41.8	23.1	31.4	27.0	39.2
1897	27.2	15.7	39.9	21.5	24.3	23.1	40.1
1898	28.4	16.5	47.1	27.3	30.2	29.0	43.6
1899	30.2	23.6	48.0	30.2	33.3	27.8	41.8
1900	29.6	19.5	48.0	25.3	28.1	25.7	41.2
1901	25.8	14.0	44.5	25.6	28.1	23.5	40.6
1902	34.5	21.8	50.2	27.6	34.0	29.2	45.9
1903	28.4	17.7	51.3	28.4	34.5	31.6	44.2
1904	32.1	25.7	46.3	24.3	25.6	27.2	42.1
1905	34.0	20.7	43.8	27.6	30.7	28.6	41.7
Average	29.6	19.4	46.1	26.1	30.0	27.3	42.0

a Winchester bushels. b Bushels of 32 pounds.

Average yield per acre of oats in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	31.0	36.0	35.0	37.5	35.0	39.0	39.5	36.6	39.5	35.8
New Hampshire	35.0	33.0	35.0	32.6	29.5	35.0	31.1	33.2	32.8	34.5
Vermont	33.0	38.0	37.0	34.9	33.0	40.0	38.2	37.9	39.4	37.2
Massachusetts	32.0	32.0	33.0	36.8	31.0	32.2	31.7	34.0	32.0	34.0
Rhode Island	32.0	27.0	26.0	30.9	29.4	36.2	28.1	25.4	29.4	29.3
Connecticut	29.0	28.2	28.0	31.0	28.7	34.5	31.2	33.5	34.5	34.2
New York	31.0	27.5	31.0	27.9	21.6	40.0	34.0	34.1	34.2	32.3
New Jersey	25.0	19.6	24.0	29.6	16.0	32.2	25.4	32.5	32.0	26.6
Pennsylvania	28.2	23.3	33.0	31.1	18.9	36.5	28.6	33.9	34.0	27.4
Delaware	22.0	22.0	20.0	21.0	18.5	22.6	22.2	28.2	31.2	24.5
Maryland	24.0	19.5	23.0	24.0	18.8	26.7	20.6	29.7	27.7	25.4
Virginia	12.0	16.1	14.0	14.8	14.9	17.5	13.8	21.1	17.8	18.0
West Virginia	20.0	19.5	23.0	21.0	18.7	28.6	21.7	26.4	24.1	20.6
North Carolina	13.0	14.3	12.0	13.9	14.4	12.7	11.4	15.8	15.3	16.2
South Carolina	15.5	17.2	12.0	15.5	15.8	13.1	14.0	17.1	16.3	18.5
Georgia	14.0	16.6	9.0	15.0	14.8	11.1	13.6	14.8	15.1	15.5
Florida	9.0	15.4	9.0	11.3	13.1	13.6	13.2	12.9	12.0	14.0
Ohio	32.0	30.9	36.0	38.0	31.5	41.1	30.6	40.9	35.8	32.8
Indiana	30.2	29.2	32.0	32.7	28.6	35.4	24.4	33.1	35.3	28.2
Illinois	32.0	29.0	38.0	38.0	28.2	37.7	26.6	32.0	35.5	29.5
Michigan	26.0	32.8	34.0	36.7	29.0	39.9	30.5	32.5	35.6	30.7
Wisconsin	34.0	36.1	36.0	32.0	29.1	39.9	32.8	35.0	39.0	37.4
Minnesota	26.0	36.3	32.0	25.2	32.1	39.0	32.3	39.2	37.5	32.5
Iowa	30.0	34.0	33.0	34.0	29.8	30.7	24.0	32.0	35.0	33.8
Missouri	22.0	17.0	25.0	27.4	11.2	32.5	22.1	22.7	27.2	22.8
North Dakota	23.0	30.7	30.0	10.3	32.6	38.4	27.4	37.4	38.9	32.5
South Dakota	22.0	26.8	26.0	21.5	28.8	34.8	38.6	39.0	39.0	36.4
Nebraska	31.0	32.1	30.0	21.8	19.8	34.6	29.5	30.7	31.0	29.5
Kansas	24.0	18.0	29.0	31.6	18.6	33.5	26.2	17.8	27.1	23.6
Kentucky	18.0	22.4	18.0	21.3	19.7	22.2	20.1	24.0	25.5	21.5
Tennessee	10.0	18.7	14.0	16.6	17.5	17.3	18.5	21.1	20.2	21.5
Alabama	13.0	16.8	10.0	14.4	14.5	10.9	15.8	14.9	16.5	17.2
Mississippi	14.0	18.5	10.0	14.0	15.2	15.4	15.0	19.2	18.5	18.0
Louisiana	18.0	18.1	18.0	18.0	13.4	15.2	15.9	18.4	16.0	17.2
Texas	25.0	29.7	25.0	38.0	16.3	23.2	35.5	32.0	31.4	34.8
Indian Territory	......	......	......	......	25.0	32.6	30.0	32.2	36.0	34.2
Oklahoma	......	......	......	......	20.7	47.8	26.4	21.2	33.0	34.4
Arkansas	17.0	22.8	19.0	22.2	12.3	20.0	18.6	22.7	20.3	20.5
Montana	42.0	40.6	38.0	39.0	42.0	41.9	46.4	37.7	41.3	43.2
Wyoming	35.0	31.2	30.0	34.2	41.0	36.0	29.4	30.2	39.9	39.5
Colorado	34.0	35.8	27.0	32.8	33.8	26.8	33.3	35.4	35.0	40.4
New Mexico	35.5	38.8	24.0	30.1	31.6	19.1	22.6	19.6	29.5	34.6
Arizona	......	......	......	......	35.0	31.7	35.5	30.1	31.2	34.4
Utah	35.0	39.7	34.0	35.9	33.0	35.5	36.4	37.6	39.8	43.7
Nevada	......	......	......	......	43.0	34.8	28.6	37.0	37.2	38.8
Idaho	36.3	43.6	34.0	36.6	38.3	42.1	41.5	39.3	39.4	40.7
Washington	48.0	41.9	37.0	34.4	47.5	46.2	47.9	44.9	50.0	43.2
Oregon	32.0	27.0	30.0	18.5	31.5	28.7	33.8	23.1	24.1	33.8
California	18.0	33.0	31.0	24.6	30.4	30.5	34.8	34.1	28.0	31.5
General average	27.2	28.4	30.2	29.6	25.8	34.5	28.4	32.1	34.0	31.2

Average value per acre of oats in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$9.92	$12.24	$13.30	$14.25	$17.50	$17.55	$17.77	$16.47	$16.55	$15.75
New Hampshire	13.30	12.54	13.65	12.39	15.34	15.40	14.93	15.60	14.10	15.18
Vermont	10.56	13.30	13.69	12.56	16.50	17.20	16.81	16.68	15.76	16.00
Massachusetts	10.56	11.84	12.54	13.98	17.05	14.49	15.53	15.30	13.76	14.96
Rhode Island	10.88	9.99	9.62	11.74	15.88	15.57	12.65	11.94	12.35	13.19
Connecticut	9.86	10.15	10.36	10.85	15.50	14.14	14.04	14.74	14.49	14.36
New York	8.37	8.53	10.23	8.93	10.37	14.40	13.94	12.96	12.65	12.92
New Jersey	7.50	6.08	7.92	9.18	7.52	12.56	10.92	13.00	11.84	10.11
Pennsylvania	7.61	6.99	9.57	9.33	8.50	12.41	10.58	12.88	12.24	10.41
Delaware	5.06	6.60	5.00	6.30	8.33	9.49	8.88	11.56	12.48	9.31
Maryland	6.24	5.65	6.90	7.44	7.71	10.15	8.24	10.69	9.97	9.65
Virginia	3.48	4.67	4.62	5.48	6.26	7.35	5.93	9.07	6.94	7.74
West Virginia	6.00	5.85	8.05	7.14	8.04	11.73	9.98	11.62	9.40	8.24
North Carolina	4.81	5.29	4.92	6.26	7.34	6.48	5.93	8.22	7.19	7.94
South Carolina	6.98	7.74	5.64	7.44	9.80	7.73	8.26	10.26	8.96	10.54
Georgia	5.88	7.97	4.32	7.35	9.92	5.88	7.48	8.14	8.00	8.68
Florida	4.77	8.32	4.50	5.65	9.43	8.30	7.92	7.74	6.24	9.52
Ohio	6.40	7.42	9.00	9.88	12.28	13.15	11.02	13.09	11.10	10.82
Indiana	5.74	6.72	7.36	7.52	10.87	9.91	7.81	9.93	9.53	9.02
Illinois	5.76	6.67	8.36	8.74	11.28	10.56	8.51	9.60	9.94	9.14
Michigan	5.98	8.86	9.52	9.54	11.89	13.17	10.98	10.72	10.68	10.13
Wisconsin	6.46	8.66	8.28	7.86	11.35	11.97	11.15	9.80	10.53	11.59
Minnesota	4.94	7.62	7.04	6.05	10.91	10.53	9.69	10.19	9.00	8.77
Iowa	4.80	8.16	6.27	6.80	10.73	7.67	6.96	8.00	8.40	9.13
Missouri	4.18	3.91	6.00	6.30	4.82	9.10	7.07	7.72	8.16	7.52
North Dakota	5.98	7.98	8.10	3.30	10.76	10.37	8.49	8.98	8.95	8.78
South Dakota	3.96	5.63	5.98	5.16	9.79	10.09	11.19	9.75	8.97	9.10
Nebraska	4.65	6.42	6.60	5.23	7.33	8.65	7.97	7.67	7.44	7.67
Kansas	5.32	3.96	6.38	7.27	8.00	10.65	7.86	5.87	7.59	7.32
Kentucky	4.86	6.05	5.76	6.60	8.08	7.99	8.24	9.60	8.58	8.17
Tennessee	2.80	5.24	4.48	5.81	7.87	7.27	7.77	7.80	7.88	8.82
Alabama	5.59	6.89	4.30	6.34	9.28	6.00	8.53	8.05	8.42	8.77
Mississippi	6.16	7.77	5.00	6.44	9.58	7.85	7.65	9.98	9.25	8.82
Louisiana	6.84	6.88	7.20	7.20	8.04	7.60	7.31	8.28	7.20	7.74
Texas	6.75	8.32	7.50	11.40	9.78	11.37	15.62	14.08	12.56	14.27
Indian Territory					11.50	12.06	10.50	12.24	11.88	10.94
Oklahoma					10.35	16.25	8.98	7.63	9.57	9.63
Arkansas	5.61	6.61	6.46	7.77	7.01	8.20	8.18	9.76	8.53	8.61
Montana	13.86	14.21	14.82	16.38	15.12	15.08	16.24	17.34	17.76	19.01
Wyoming	12.25	12.48	12.00	16.07	19.68	18.00	14.70	11.78	16.36	15.80
Colorado	10.88	14.68	11.34	14.10	16.90	13.67	13.65	16.28	14.35	18.18
New Mexico	14.56	15.91	10.56	14.45	15.96	12.99	14.01	11.17	17.11	17.99
Arizona					21.00	23.78	21.65	22.27	19.97	22.36
Utah	11.55	15.09	13.60	15.80	16.83	16.68	17.84	17.67	17.51	19.66
Nevada					30.10	24.36	19.45	23.31	19.34	24.83
Idaho	11.62	15.70	12.92	14.64	16.85	20.21	18.68	19.65	16.55	17.50
Washington	16.80	16.76	14.06	13.76	16.63	22.64	18.20	19.31	20.50	17.71
Oregon	11.20	10.80	12.30	7.59	10.71	11.77	14.87	10.86	10.36	14.53
California	8.82	16.50	14.57	11.32	13.38	15.55	18.79	19.44	14.28	16.38
General average	5.75	7.23	7.52	7.63	10.29	10.60	9.68	10.05	9.88	9.89

Average farm price of oats per bushel in the United States, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Maine	32	34	38	38	50	45	45	45	43	44
New Hampshire	38	38	39	38	52	44	48	47	43	44
Vermont	32	35	37	36	50	43	44	44	40	43
Massachusetts	33	37	38	38	55	45	49	45	43	44
Rhode Island	34	37	37	38	54	43	45	47	42	45
Connecticut	34	36	37	35	54	41	45	44	42	42
New York	27	31	33	32	48	36	41	38	37	40
New Jersey	30	31	33	31	47	39	43	40	37	38
Pennsylvania	27	30	29	30	45	34	37	38	36	38
Delaware	23	30	25	30	45	42	40	41	40	38
Maryland	26	29	30	31	41	38	40	36	36	38
Virginia	29	29	33	37	42	42	43	43	39	43
West Virginia	30	30	35	34	43	41	46	44	[illegible]	40
North Carolina	37	37	41	45	51	51	52	52	47	49
South Carolina	45	45	47	48	62	59	59	60	55	57
Georgia	42	48	48	49	67	53	55	55	53	56
Florida	53	54	50	50	72	61	60	60	52	68
Ohio	20	24	25	26	39	32	[illegible]	32	31	[illegible]
Indiana	19	23	23	23	38	28	32	30	27	32

Average farm price of oats per bushel in the United States, December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Illinois	18	23	22	23	40	28	32	30	28	31
Michigan	23	27	28	26	41	33	36	33	30	33
Wisconsin	19	24	23	23	39	30	34	28	27	31
Minnesota	19	21	22	24	34	27	30	26	24	27
Iowa	16	24	19	20	36	25	29	25	24	27
Missouri	19	23	24	23	43	28	32	34	30	33
North Dakota	26	26	27	32	33	27	31	24	23	27
South Dakota	18	21	23	24	34	29	29	25	23	25
Nebraska	15	20	22	24	37	25	27	25	24	26
Kansas	18	22	22	23	43	30	30	33	28	31
Kentucky	27	27	32	31	41	36	41	40	35	38
Tennessee	28	28	32	35	45	42	42	37	39	41
Alabama	43	41	43	44	64	55	54	54	51	51
Mississippi	44	42	50	46	63	51	51	52	50	49
Louisiana	38	38	40	40	60	50	46	45	45	45
Texas	27	28	30	30	60	49	44	44	40	41
Indian Territory	......	......	......	......	46	37	35	38	33	32
Oklahoma	......	......	......	......	50	34	34	36	29	28
Arkansas	33	29	34	35	57	41	44	43	42	42
Montana	33	35	39	42	36	36	35	46	43	44
Wyoming	35	40	40	47	48	50	50	39	41	40
Colorado	32	41	42	43	50	51	41	46	41	45
New Mexico	41	41	44	48	60	68	62	57	58	52
Arizona	......	......	......	......	60	75	61	74	64	65
Utah	33	38	40	44	51	47	49	47	44	45
Nevada	......	......	......	......	70	70	68	63	52	64
Idaho	32	36	38	40	44	48	45	50	42	43
Washington	35	40	38	40	35	49	38	43	41	41
Oregon	35	40	41	41	34	41	44	47	43	43
California	49	50	47	46	44	51	54	57	51	52
General average	21.2	25.5	24.9	25.8	39.9	30.7	34.1	31.3	29.1	31.7

Wholesale prices of oats per bushel in leading cities of the United States, 1902–1906.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Milwaukee.		Duluth.		Detroit.		San Francisco.	
	No. 2, mixed.		No. 2, mixed.		No. 2, mixed.		No. 2.		No. 2, white.		No. 2.		No. 2, white.		No. 1, white (per cwt.).	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1902.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
Jan	46½	53	48	52	46	50	38⅛	46¼	44¼	49	40⅜	47⅛	45	50½	$1.25	$1.40
Feb	48	50	47	49½	46	48	40¾	44¼	42¾	47	38⅝	43¼	46	47½	1.27½	1.42½
Mar	46¾	52	47½	49	45½	47	40¼	45½	44	47	40	43	46	48¼	1.25	1.40
Apr	46½	49½	47½	49	44	46½	41	44½	43¾	47¼	40	46⅛	46	48½	1.27½	1.45
May	45½	48	47½	48½	44	46	41	49½	44¼	46	42⅛	45⅝	46	48½	1.35	1.50
June	44½	55	47½	55	43	52	39	48½	43	54	28¾	34	46½	57	1.35	1.50
July	55	64¾	54	60	32½	57	[illegible]	56	51½	58	30½	34½	57	61	1.20	1.35
Aug	34½	65	31	59	27	31	25	31	33¼	58	27½	30	34¾	60	1.15	1.30
Sept	32	35	29	32	28½	31½	26⅛	27¼	31½	35	29	31½	36¼	39½	1.17½	1.30
Oct	33	34½	29½	33½	30	32	27¼	30	32	34	29½	32	38½	41¼	1.15	1.32½
Nov	34	36	32½	35½	29¾	34	27¾	29½	30½	34	28½	32	41¼	48	1.20	1.35
Dec	36	38¼	35½	40	33	39	29¼	32	32½	34	31	32	48½	51	1.25	1.40
1903.																
Jan	38½	44	39½	42½	35	39	31¾	34½	33½	36¾	32½	34½	36	38	1.22½	1.35
Feb	42½	43¾	39½	41	37½	39½	33½	36	36	36¾	34	35½	38	40	1.22½	1.37½
Mar	42	44½	40	41½	37	39	31¼	34⅜	36	36	31	34½	38	39	1.22½	1.32½
Apr	38	42	38	41½	33½	37	32⅛	35¾	36	36¾	32½	33½	36½	38½	1.20	1.32½
May	38	39½	37½	39	33	37½	33⅜	38¼	36	38	33½	35½	37	39	1.20	1.30
June	39¾	43¾	38½	44	36	43½	35½	43¼	36½	40½	35	40	39	45	1.17½	1.27½
July	40	43	36½	44	31½	41½	33½	45	36½	41	32½	37½	36	41½	1.17½	1.30
Aug	38	40½	34½	39	33	35¼	33⅝	36¾	37	38½	34	35½	35½	36¾	1.17½	1.32½
Sept	38	42	39	41½	35	39	35½	38	37	40	35¾	38⅜	37½	40	1.17½	1.32½
Oct	40½	42	40	41	36½	39	34½	38½	37½	39	35	37½	38½	39¾	1.20	1.32½
Nov	40	42	38½	40½	35½	37½	33¼	38½	36½	38½	32⅝	35¼	36½	38½	1.25	1.32½
Dec	40½	42½	39	40½	37	39	34¼	38	37½	38	34¼	35⅞	37½	39	1.25	1.32½

Wholesale prices of oats per bushel in leading cities of the United States, 1902–1906—Continued.

Date.	New York.		Baltimore.		Cincinnati.		Chicago.		Milwaukee.		Duluth.		Detroit.		San Francisco.	
	No. 2, mixed.		No. 2, mixed.		No. 2, mixed.		No. 2.		No. 2, white.		No. 3.		No. 3, white.		No. 1, white (per cwt.).	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
1904.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*		
Jan	42½	45½	41	43½	38	42½	36½	41½	35	41	35½	39½	39	42½	$1.25	$1.37½
Feb	46	55½	43	48	41½	44½	39⅜	46	40	44½	38⅞	42⅞	42¼	48¼	1.25	1.37½
Mar	46	55½	45½	47½	41	44½	38	42¾	39	44	38¼	40⅜	44	46½	1.27½	1.37½
Apr	43½	47	43	46½	40	43	36⅛	41⅞	37	43¾	37¼	41	42½	45¼	1.27½	1.40
May	45½	47	43½	45½	41½	42½	39⅝	44¾	41	45	40	43	45	45¾	1.32½	1.50
June	44¾	46	43½	45¼	41	44	39¾	42¼	38	44	40	42½	42½	46½	1.40	1.50
July	41	45	43½	45½	40	41½	38½	45	37	41	36	38	41½	44	1.30	1.50
Aug	35½	43	34½	45	32½	40½	31½	40	31¾	42	32¼	38	33	43½	1.30	1.50
Sept	34½	36	33	35	33	34½	29⅝	33½	29½	33½	30	32⅜	32	33½	1.40	1.52½
Oct	34½	36	33	34	31½	33½	28¼	31½	28½	33	27¾	30⅝	31¾	34	1.40	1.55
Nov	35	35	33	35¾	31	33½	29	32¼	29½	32	29	29⅝	32	32½	1.45	1.60
Dec	34½	36½	35½	36	32¾	33¾	28¼	32	29	32	28¼	29⅝	32½	33½	1.45	1.60
1905.											(a)					
Jan	35½	37½	36¼	37	32¾	33½	29⅝	31	31½	32½	28¾	29¾	33½	34½	1.45	1.60
Feb	36	37	35	36½	32¾	33½	29½	32¼	32	33	28⅝	30¼	33¼	34¼	1.45	1.60
Mar	35¾	37½	35	36¾	31¾	34½	29¼	33¼	32	34½	28½	31¼	33½	34¼	1.45	1.60
Apr	34¼	36	33½	35½	30½	32½	28⅜	32	32	33½	28½	29¾	33	34¼	1.45	1.60
May	34½	35½	33½	34½	30½	32¾	28⅝	32	31¾	34	28⅝	31⅜	33	34¾	1.45	1.67½
June	34½	36	33¾	36½	32½	33½	30¼	33¼	33	34½	30⅜	32½	33¾	34½	1.65	1.80
July	33½	36½	33	36½	28	34	27	34¼	33	35½	27½	32¾	35	37	......	......
Aug	29	33	27½	32½	25	32	25¼	29½	27⅛	34	25½	28⅝	27	35½	......	......
Sept	29	33½	28	32½	26	30	25	30	28	30	25¼	28⅛	26¼	30½	1.37½	1.47½
Oct	32½	35¾	32	35	29	32	27½	30¾	29	32	26⅞	29⅞	29¾	32¾	1.37½	1.45
Nov	34½	36	34	34¾	31½	33½	29	31⅜	31	32	28⅜	30	32¾	33	1.37½	1.50
Dec	36	37	34	36½	33	35½	29½	32¾	31½	33½	29	30⅛	32¾	35	1.45	1.55
1906.									No 3, white							
Jan	36	37½	34½	37	32½	34	29⅛	32	30	32	29	30	33	35	......	......
Feb	34	36	34	35½	32	33½	29⅜	30¾	29	31½	28½	29½	32½	33¾	......	......
Mar	34½	36½	34¼	35¾	32	33½	28⅞	29¾	29	32¼	28⅛	29¾	32	34	......	......
Apr	36¼	37	35½	38	33	35	30⅞	32¾	30½	33¾	29⅞	31½	33¼	35	......	......
May	37	39	37½	39	33	37	32⅛	34¾	32	35½	31⅛	34½	35¼	37¾	......	......
June	39	45	38½	45½	37	43	33¾	42¾	33¾	43	33¾	41	37¼	43¼	......	......
July	40	43½	38½	42½	34	41	30¼	39¼	33	40	31¾	38	38	42	......	......
Aug	34½	39	33½	39½	30	34	29⅛	32	29	35½	30	31	32	39	......	......
Sept	34½	37½	34	37	31½	36	30	34¼	29	34	29¼	33	33	36½	......	......
Oct	37½	38½	37	37¾	35	36½	32¼	34¾	32	34½	31¼	33	36	36½	......	......
Nov	37½	39½	37	38½	35	36½	33	35¼	32	34¾	32	32⅝	36½	38½	......	......
Dec	38	39	38	39½	36	38	33	35¾	32½	35½	31⅞	34	35	37	......	......

a No grade of oats in Duluth for 1905.

BARLEY.

Barley crop of countries named, 1902–1906.

[Substantially the crop of the world.]

Country.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	134,954,000	131,861,000	139,749,000	136,651,000	178,916,000
Canada:					
New Brunswick	110,000	108,000	96,000	100,000	102,000
Ontario	22,580,000	25,147,000	25,342,000	25,030,000	26,049,000
Manitoba	12,222,000	8,982,000	11,530,000	14,507,000	18,085,000
Saskatchewan	308,000	687,000	617,000	922,000	1,358,000
Alberta	488,000	1,111,000	1,659,000	1,830,000	2,242,000
Other	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Total Canada	38,708,000	39,035,000	42,244,000	45,389,000	50,836,000
Mexico	6,045,000	9,061,000	7,355,000	6,000,000	6,000,000
Total North America	179,707,000	179,957,000	189,348,000	188,040,000	235,752,000

Barley crop of countries named, 1902–1906—Continued.

Country.	1902.	1903.	1904.	1905.	1906.
EUROPE.					
Austria-Hungary:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Austria	73,788,000	73,873,000	66,815,000	70,469,000	76,024,000
Hungary proper	62,350,000	64,577,000	49,915,000	62,452,000	69,747,000
Croatia-Slavonia	3,259,000	3,839,000	2,285,000	2,864,000	3,007,000
Bosnia-Herzegovina	3,208,000	4,145,000	3,496,000	3,236,000	3,606,000
Total Austria-Hungary	142,605,000	146,434,000	122,511,000	139,021,000	152,384,000
Belgium	4,974,000	3,923,000	5,003,000	4,518,000	5,000,000
Bulgaria	11,000,000	12,773,000	12,911,000	12,080,000	12,882,000
Denmark	23,287,000	23,340,000	22,708,000	21,146,000	22,000,000
Finland	3,628,000	5,233,000	4,916,000	5,000,000	5,000,000
France	41,948,000	43,345,000	38,338,000	40,841,000	37,004,000
Germany	142,392,000	152,653,000	135,409,000	134,204,000	142,901,000
Italy	6,000,000	8,000,000	7,000,000	8,000,000	8,000,000
Netherlands	4,652,000	3,823,000	3,606,000	4,013,000	4,000,000
Norway	2,143,000	3,255,000	2,496,000	3,464,000	3,000,000
Roumania	24,586,000	29,716,000	11,567,000	26,383,000	33,539,000
Russia:					
Russia proper	274,899,000	289,699,000	290,766,000	272,694,000	243,620,000
Poland	22,185,000	20,819,000	17,705,000	22,732,000	23,351,000
Northern Caucasia	35,530,000	39,980,000	31,254,000	43,430,000	37,319,000
Total Russia (European)	332,614,000	350,498,000	339,725,000	338,856,000	304,290,000
Servia	3,495,000	3,424,000	3,162,000	3,670,000	4,848,000
Spain	81,279,000	64,359,000	53,800,000	45,974,000	91,185,000
Sweden	12,283,000	13,570,000	13,452,000	12,858,000	14,952,000
United Kingdom:					
Great Britain—					
England	56,679,000	50,628,000	48,511,000	48,778,000	51,543,000
Scotland	8,394,000	7,739,000	7,408,000	8,257,000	7,803,000
Wales	3,518,000	2,981,000	3,077,000	2,906,000	3,116,000
Ireland	8,273,000	6,076,000	5,478,000	7,181,000	7,000,000
Total United Kingdom	76,864,000	67,424,000	64,474,000	67,122,000	69,462,000
Total Europe	913,750,000	931,770,000	841,078,000	867,150,000	910,447,000
ASIA.					
Cyprus	1,374,000	3,969,000	3,122,000	3,000,000	3,000,000
Japanese Empire:					
Japan	74,078,000	59,737,000	80,795,000	77,436,000	73,000,000
Formosa	13,000	38,000	58,000	50,000	50,000
Total Japanese Empire	74,091,000	59,775,000	80,853,000	77,486,000	73,050,000
Russia:					
Central Asia	3,008,000	2,759,000	2,262,000	3,145,000	5,136,000
Siberia	2,628,000	4,213,000	4,268,000	4,965,000	2,614,000
Total Russia (Asiatic)	5,636,000	6,972,000	6,530,000	8,110,000	7,750,000
Total Asia	81,101,000	70,716,000	90,505,000	88,596,000	83,800,000
AFRICA.					
Algeria	47,912,000	38,496,000	36,125,000	35,000,000	40,000,000
Anglo-Egyptian Sudan	200,000	216,000	251,000	327,000	300,000
Cape of Good Hope	800,000	949,000	850,000	850,000	850,000
Natal	8,000	4,000	6,000	7,000	6,000
Tunis	3,201,000	11,322,000	14,815,000	7,119,000	7,863,000
Total Africa	52,121,000	50,987,000	52,047,000	43,303,000	49,019,000
AUSTRALASIA.					
Australia:					
Queensland	286,000	4,000	527,000	342,000	64,000
New South Wales	107,000	19,000	180,000	275,000	115,000
Victoria	716,000	579,000	1,256,000	902,000	1,096,000
South Australia	251,000	327,000	503,000	358,000	522,000
Western Australia	37,000	48,000	55,000	39,000	51,000
Tasmania	173,000	207,000	219,000	168,000	97,000
Total Australian Commonwealth	1,570,000	1,184,000	2,740,000	2,084,000	1,945,000
New Zealand	883,000	1,172,000	1,197,000	1,164,000	1,056,000
Total Australasia	2,453,000	2,356,000	3,937,000	3,248,000	3,001,000
Grand total	1,229,132,000	1,235,786,000	1,176,915,000	1,190,337,000	1,282,019,000

Visible supply of barley in the United States and Canada, first of each month, for ten years.[a]

Month.	1897–98.	1898–99.	1899–1900.	1900–1901.	1901–2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	1,574,000	587,000	1,059,000	1,038,000	528,000
August	1,051,000	584,000	694,000	702,000	335,000
September	1,578,000	548,000	1,055,000	1,158,000	956,000
October	2,630,000	2,125,000	1,739,000	2,779,000	3,610,000
November	4,267,000	3,777,000	3,925,000	5,396,000	4,813,000
December	6,318,000	4,406,000	4,695,000	6,053,000	5,416,000
January	5,115,000	4,372,000	3,122,000	5,395,000	4,580,000
February	3,455,000	4,017,000	2,303,000	4,331,000	5,244,000
March	2,571,000	3,067,000	2,138,000	3,903,000	5,065,000
April	1,492,000	2,626,000	1,712,000	2,879,000	4,075,000
May	1,159,000	1,913,000	1,720,000	1,761,000	2,146,000
June	815,000	1,555,000	1,267,000	1,351,000	1,836,000

Month.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	847,000	602,000	2,046,000	2,557,000	1,620,000
August	217,000	471,000	1,656,000	1,031,000	1,814,000
September	419,000	1,024,000	1,694,000	1,358,000	1,244,000
October	2,460,000	5,047,000	6,551,000	5,524,000	3,520,000
November	5,064,000	7,313,000	9,329,000	8,509,000	4,476,000
December	5,680,000	7,975,000	9,620,000	10,217,000	5,156,000
January	4,389,000	6,907,000	10,403,000	10,657,000	4,698,000
February	3,843,000	6,338,000	8,801,000	8,526,000	4,137,000
March	3,107,000	5,441,000	6,952,000	7,686,000	3,934,000
April	2,426,000	4,975,000	4,674,000	6,567,000	3,708,000
May	1,493,000	3,969,000	3,354,000	4,251,000	3,441,000
June	1,133,000	3,105,000	2,231,000	2,053,000	....

[a] These figures represent stocks available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals as reported by Bradstreet's.

Condition of the barley crop of the United States, monthly, 1891–1906.

Year.	June.	July.	August.	September.	Year.	June.	July.	August.	September.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1891	90.3	90.9	93.8	94.3	1899	91.4	92.0	93.6	86.7
1892	92.1	92.0	91.1	87.4	1900	86.2	76.3	71.6	70.7
1893	88.3	88.8	84.6	83.8	1901	98.8	91.3	86.9	85.8
1894	82.2	76.8	69.8	71.5	1902	93.6	93.7	90.2	89.7
1895	90.3	91.9	87.2	87.6	1903	91.5	86.8	83.4	82.1
1896	98.0	88.1	82.9	83.1	1904	90.5	88.5	88.1	87.4
1897	87.4	88.5	87.5	86.4	1905	93.7	91.5	89.5	87.8
1898	78.8	85.7	79.3	79.2	1906	93.5	92.5	90.3	89.4

Acreage, production, value, prices, exports, etc., of barley of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel, No. 2.				Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
						December.		May of following year.			
						Low.	High.	Low.	High.		
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1866	492,532	22.9	11,283,807	70.2	7,916,342	59	70	85	100	....	3,247,250
1867	1,131,217	22.7	25,727,000	70.1	18,027,746	150	180	227	250	9,810	3,783,966
1868	937,498	24.4	22,896,100	109.0	24,948,127	140	170	149	175	59,077	5,069,880
1869	1,025,795	27.9	28,652,200	70.8	20,298,164	74	85	50	62	255,490	6,727,597
1870	1,108,924	23.7	26,295,400	79.1	20,792,213	68	80	72	95	340,093	4,866,700
1871	1,113,735	24.0	26,718,500	75.8	20,264,015	55½	64	55	71	86,891	5,565,591
1872	1,397,082	19.2	26,846,400	68.6	18,415,839	60	70	71	85	482,410	4,244,751
1873	1,387,106	23.1	32,044,491	86.7	27,794,229	132	158	130	155	320,399	4,891,189

Acreage, production, value, prices, exports, etc., of barley of the United States, 1866-1906—Continued.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel, No. 2.[a] December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1874	1,580,626	20.6	32,552,500	86.0	27,997,824	120	129½	115	137	91,118	6,255,063
1875	1,789,902	20.6	36,908,600	74.1	27,367,522	81	88	62½	72½	317,781	10,285,957
1876	1,766,511	21.9	38,710,500	63.0	24,402,691	63¾	68½	80	85	1,186,129	6,702,965
1877	1,614,654	21.3	34,441,400	62.8	21,629,130	56¼	64	46½	52½	3,921,501	6,764,228
1878	1,790,400	23.6	42,245,630	57.9	24,454,301	91	100	64	73	715,536	5,720,979
1879	1,680,700	24.0	40,283,100	58.9	23,714,444	86	92	75	80	1,128,923	7,135,258
1880	1,843,329	24.5	45,165,346	66.6	30,090,742	100	120	95	105	885,246	9,528,616
1881	1,967,510	20.9	41,161,330	82.3	33,862,513	101	107	100	100	205,930	12,182,722
1882	2,272,103	21.5	48,953,926	62.9	30,768,015	79	82	80	80	433,005	10,050,687
1883	2,379,009	21.1	50,136,097	58.7	29,420,423	62	67	65	74	724,955	8,596,122
1884	2,608,818	23.5	61,203,000	48.7	29,779,170	53	58	65	65	629,130	9,986,507
1885	2,729,359	21.4	58,360,000	56.3	32,867,696	62	65	58	60	252,183	10,197,115
1886	2,652,957	22.4	59,428,000	53.6	31,840,510	51	54	57	57	1,305,300	10,355,594
1887	2,901,953	19.6	56,812,000	51.9	29,464,390	80	80	69	77	550,884	10,831,461
1888	2,996,382	21.3	63,884,000	59.0	37,672,032	......	......	......	......	1,440,321	11,368,414
1889	3,220,834	24.3	78,332,976	41.6	32,614,271	58	58	......	......	1,408,311	11,332,545
1890	3,135,302	21.4	67,168,344	62.7	42,140,502	......	......	......	......	973,062	5,078,733
1891	3,352,579	25.9	86,839,153	52.4	45,470,342	......	......	......	......	2,800,075	3,146,328
1892	3,400,361	23.6	80,096,762	47.5	38,026,062	65	67	65	65	3,035,267	1,970,129
1893	3,220,371	21.7	69,869,495	41.1	28,729,386	52	54	55	60	5,219,405	791,061
1894	3,170,602	19.4	61,400,465	44.2	27,134,127	53½	55½	51	52	1,563,754	2,116,816
1895	3,299,973	26.4	87,072,744	33.7	29,312,413	33	40	25	36	7,680,331	837,384
1896	2,950,539	23.6	69,695,223	32.3	22,491,241	22	37	24½	35	20,030,301	1,271,787
1897	2,719,116	24.5	66,685,127	37.7	25,142,139	25½	42	36	53	11,237,077	124,804
1898	2,583,125	21.6	55,792,257	41.3	23,064,359	40	50½	36	42	2,267,403	110,475
1899	2,878,229	25.5	73,381,563	40.3	29,594,254	35	45	36	44	23,661,662	189,757
1900	2,894,282	20.4	58,925,833	40.8	24,075,271	37	61	37	57	6,293,207	171,004
1901	4,295,744	25.6	109,932,924	45.2	49,705,163	56	63	64	72	8,714,268	57,406
1902	4,661,063	29.0	134,954,023	45.9	61,898,634	36	70	48	56	8,429,141	56,462
1903	4,993,137	26.4	131,861,391	45.6	60,166,313	42	61½	38	59	10,881,627	90,708
1904	5,145,878	27.2	139,748,958	42.0	58,651,807	38	52	40	50	10,661,655	81,020
1905	5,095,528	26.8	136,651,020	40.3	55,047,166	37	53	42	55½	17,729,360	18,049
1906	6,323,757	28.3	178,916,484	41.5	74,235,997	44	56	......	......	....	....

[a] Prices from 1895 on are for No. 3 grade.

Acreage, production, and value of barley in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
Maine	7,661	31.5	241,322	65	156,859
New Hampshire	1,507	21.4	32,250	64	20,640
Vermont	12,810	32.8	420,168	62	260,504
New York	86,193	26.3	2,266,876	55	1,246,782
Pennsylvania	8,518	25.0	212,950	55	117,122
Maryland	1,436	31.0	44,516	47	20,923
Virginia	2,398	28.6	68,583	56	38,406
Ohio	21,775	30.0	653,250	46	300,495
Indiana	8,486	29.4	249,488	52	129,734
Illinois	25,298	30.0	758,940	42	318,755
Michigan	70,000	26.1	1,827,000	49	895,230
Wisconsin	728,000	30.7	22,349,600	45	10,057,320
Minnesota	1,128,265	28.0	31,591,420	35	11,056,997
Iowa	556,000	28.3	15,734,800	35	5,507,180
Missouri	1,648	24.2	39,882	48	19,143
North Dakota	613,000	25.8	15,815,400	33	5,219,082
South Dakota	790,000	29.0	22,910,000	32	7,331,200
Nebraska	120,000	28.0	3,360,000	31	1,041,600
Kansas	359,000	23.5	8,436,500	33	2,784,045
Kentucky	673	26.0	17,498	55	9,624
Tennessee	1,045	23.0	24,035	60	14,421
Texas	4,601	24.5	112,724	61	68,762
Oklahoma	15,666	29.8	466,847	33	154,060
Montana	14,313	33.0	472,329	56	264,504
Wyoming	3,000	31.4	94,200	64	60,288
Colorado	18,531	41.0	759,771	54	410,276

Acreage, production, and value of barley in the United States in 1906, by States—Con.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
New Mexico	556	27.0	15,012	63	9,458
Arizona	13,404	42.2	565,649	76	429,893
Utah	12,000	44.0	528,000	54	285,120
Nevada	7,089	36.8	260,875	69	180,004
Idaho	47,028	41.0	1,928,148	50	964,074
Washington	158,994	36.5	5,803,281	49	2,843,608
Oregon	59,862	35.0	2,095,170	52	1,089,488
California	1,425,000	27.2	38,760,000	54	20,930,400
United States	6,323,757	28.3	178,916,484	41.5	74,235,997

Average yield per acre of barley in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	25.0	27.0	29.0	27.4	27.5	29.4	29.9	32.7	29.0	31.5
New Hampshire	22.5	23.5	25.0	22.7	21.5	21.2	19.8	20.7	20.8	21.4
Vermont	28.5	30.0	31.0	29.1	29.6	29.7	29.2	33.1	31.5	32.8
Massachusetts	34.5	24.5	30.0	25.8						
Rhode Island	28.0	28.0	29.0	28.0						
New York	25.0	25.2	24.0	22.0	14.0	28.5	26.6	26.8	25.7	26.3
Pennsylvania	24.5	19.4	21.0	19.0	17.2	21.0	21.3	22.6	25.0	25.0
Maryland					18.0	27.0	25.9	21.8	31.0	31.0
Virginia					24.9	18.3	24.4	24.7	28.0	28.6
Ohio	28.5	28.7	28.0	27.0	24.9	32.3	23.3	27.5	26.2	30.0
Indiana	19.0	23.4	25.0	24.6	25.4	28.0	22.8	29.2	28.0	29.4
Illinois	25.0	27.3	29.0	25.6	24.5	28.6	28.2	27.1	30.0	30.0
Michigan	21.5	25.2	24.0	23.9	22.8	28.6	25.2	24.1	27.0	26.1
Wisconsin	28.0	29.1	30.0	25.5	27.2	33.8	27.7	30.0	29.9	30.7
Minnesota	25.5	28.4	25.0	22.4	25.8	28.6	25.3	28.4	27.0	28.0
Iowa	24.0	26.0	26.0	26.4	23.6	26.3	23.4	27.8	26.0	28.3
Missouri	19.0	20.0	18.0	20.8	16.5	25.0	18.3	20.3	23.0	24.2
North Dakota	22.5	26.4	24.0	8.2	28.2	31.6	21.6	28.1	28.0	25.8
South Dakota	20.0	23.0	23.0	14.3	22.4	29.2	31.4	28.0	30.0	29.0
Nebraska	22.0	27.1	26.0	17.6	16.0	31.1	26.6	27.4	27.5	28.0
Kansas	17.5	28.0	17.0	21.5	15.9	16.0	31.9	21.6	22.0	23.5
Kentucky	20.0	16.0	21.0	28.6	19.4	25.9	21.4	20.6	24.0	26.0
Tennessee	18.0	18.0	11.0	14.7	16.8	16.0	20.6	22.0	21.6	23.0
Texas	25.0	20.0	18.0	24.6	13.5	21.3	24.4	31.0	24.0	24.5
Oklahoma					22.0	36.0	26.9	30.1	26.0	29.8
Montana	38.0	36.0	35.0	38.8	39.0	37.0	40.2	29.9	33.0	33.0
Wyoming					32.5	24.4	21.3	30.1	31.7	31.4
Colorado	28.0	30.5	28.0	24.8	28.7	26.3	38.3	37.1	33.0	41.0
New Mexico	32.5	33.8	32.0	29.0	31.7	16.1	23.1	23.6	21.0	27.0
Arizona					28.7	25.2	32.8	33.6	44.0	42.2
Utah	31.0	37.0	33.0	36.5	35.0	32.1	37.5	38.3	37.0	44.0
Nevada					33.0	34.3	34.6	35.9	34.0	36.8
Idaho	35.0	35.0	35.0	32.8	40.2	46.3	34.4	37.4	40.0	41.0
Washington	45.0	39.8	35.0	33.4	43.5	43.7	37.9	34.8	40.0	36.5
Oregon	32.5	29.1	28.0	28.9	30.6	31.9	33.2	28.7	31.0	35.0
California	23.0	10.5	26.0	16.7	26.0	26.0	25.7	22.7	21.5	27.2
General average	24.5	21.6	25.5	20.4	25.6	29.0	26.4	27.2	26.8	28.3

Average value per acre of barley in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$13.75	$15.12	$17.11	$16.99	$18.43	$19.99	$21.23	$23.22	$19.72	$20.48
New Hampshire	13.50	13.63	16.25	15.21	17.20	15.90	16.63	15.53	15.18	13.70
Vermont	13.11	14.10	16.12	15.13	19.54	18.12	17.52	21.85	21.18	20.34
Massachusetts	22.77	16.17	20.40	17.80						
Rhode Island	15.12	17.08	20.30	21.56						
New York	10.50	12.10	12.00	11.22	7.84	15.68	14.63	15.28	13.88	14.47
Pennsylvania	9.55	8.54	10.29	9.50	10.15	11.34	11.93	12.66	13.75	13.75
Maryland					9.36	13.23	12.95	13.95	14.88	14.57
Virginia					11.70	9.88	13.91	15.07	15.40	16.02
Ohio	11.69	12.63	12.60	11.61	12.70	15.83	11.65	14.30	11.79	13.80

Average value per acre of barley in the United States, based upon farm value December 1, 1897–1906, by States—Continued.

State or territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Indiana	$8.36	$10.30	$11.25	$11.56	$12.95	$12.88	$11.40	$14.02	$12.60	$15.29
Illinois	9.50	10.65	13.63	12.03	12.99	12.58	12.41	11.65	12.60	12.60
Michigan	8.60	11.09	11.52	11.23	12.31	14.87	13.10	13.25	12.69	12.79
Wisconsin	8.96	11.64	12.00	11.22	13.87	15.55	13.30	12.90	12.26	13.82
Minnesota	6.12	9.37	7.75	8.51	11.61	10.58	9.36	9.09	8.64	9.80
Iowa	5.76	8.84	8.06	9.77	11.09	9.47	8.42	10.01	7.80	9.90
Missouri	7.60	7.20	7.56	9.36	9.08	13.75	9.88	12.59	10.12	11.62
North Dakota	6.07	7.66	7.92	2.87	11.28	11.38	7.78	7.87	8.40	8.51
South Dakota	4.40	6.21	6.67	4.43	9.41	11.10	10.36	8.96	8.70	9.28
Nebraska	5.28	6.78	7.80	5.81	6.56	10.26	8.78	8.49	8.52	8.68
Kansas	4.38	7.56	4.59	7.10	7.15	6.08	10.85	7.99	7.04	7.76
Kentucky	8.00	6.40	9.03	15.73	13.77	14.50	13.48	13.39	10.56	14.30
Tennessee	10.62	10.08	7.04	9.11	11.76	9.76	13.39	14.08	12.31	13.80
Texas	10.75	10.00	11.88	17.71	11.88	15.34	17.08	22.63	15.84	14.95
Oklahoma					10.78	15.12	11.84	12.04	10.40	9.83
Montana	19.00	20.52	17.85	18.62	22.23	18.87	23.32	18.54	18.48	18.48
Wyoming					21.12	18.30	15.34	17.16	18.70	20.10
Colorado	14.28	14.03	15.40	12.40	18.08	15.78	23.36	21.15	17.49	22.14
New Mexico	17.88	18.59	19.52	17.98	20.61	11.43	14.78	21.24	14.49	17.01
Arizona					19.52	22.93	23.62	31.25	35.64	32.07
Utah	13.95	17.39	17.16	20.07	18.55	18.94	22.13	21.83	19.61	23.76
Nevada					23.10	27.44	29.41	25.85	23.80	25.39
Idaho	14.70	16.80	16.10	16.40	21.31	24.54	17.89	23.56	19.20	20.50
Washington	19.35	17.91	15.40	13.03	17.83	20.10	18.95	17.05	18.80	17.89
Oregon	14.63	14.26	14.00	12.14	14.99	16.59	19.59	16.93	16.12	18.20
California	12.42	6.82	13.00	7.18	10.66	16.38	15.68	13.62	12.68	14.69
General average	9.25	8.93	10.28	8.32	11.57	13.28	12.05	11.40	10.80	11.74

Average farm price of barley per bushel in the United States December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	55	56	59	62	67	68	71	71	68	65
New Hampshire	60	58	65	67	80	75	84	75	73	64
Vermont	46	47	52	52	66	61	60	66	54	62
Massachusetts	66	66	68	69						
Rhode Island	54	61	70	77						
New York	42	48	50	51	56	55	55	57	54	55
Pennsylvania	39	44	49	50	59	54	56	56	55	55
Maryland					52	49	50	64	48	47
Virginia					47	54	57	61	55	56
Ohio	41	44	45	43	51	49	50	52	45	46
Indiana	44	44	45	47	51	46	50	48	45	52
Illinois	38	39	47	47	53	44	44	43	42	42
Michigan	40	44	48	47	54	52	52	55	47	49
Wisconsin	32	40	40	44	51	46	48	43	41	45
Minnesota	24	33	31	38	45	37	37	32	32	35
Iowa	24	34	31	37	47	36	36	36	30	35
Missouri	40	36	42	45	55	55	54	62	44	48
North Dakota	27	29	33	35	40	36	36	28	30	33
South Dakota	22	27	29	31	42	38	33	32	29	32
Nebraska	24	25	30	33	41	33	33	31	31	31
Kansas	25	27	27	33	45	38	34	37	32	33
Kentucky	40	40	43	55	71	56	63	65	44	55
Tennessee	59	56	64	62	70	61	65	64	57	60
Texas	43	50	66	72	88	72	70	73	66	61
Oklahoma					49	42	44	40	40	33
Montana	50	57	51	48	52	51	58	62	56	56
Wyoming					65	75	72	57	59	64
Colorado	51	46	55	50	63	60	61	57	53	54
New Mexico	55	55	61	62	65	71	64	90	69	63
Arizona					68	91	72	93	81	76
Utah	45	47	52	55	53	59	59	57	53	54
Nevada					70	80	85	72	70	69
Idaho	42	48	46	50	53	53	52	63	48	50
Washington	43	45	44	39	41	46	50	49	47	49
Oregon	45	49	50	42	49	52	59	59	52	52
California	54	65	50	43	41	63	61	60	59	54
General average	37.7	41.3	40.3	40.8	45.2	45.9	45.6	42.0	40.3	41.5

Average yield of barley in certain countries, in bushels per acre, 1896–1905.

Year.	United States.	Russia.	Germany.	Austria.	Hungary.	France.	United Kingdom.
	(a)	(b)	(b)	(b)	(b)	(a)	(a)
1896	23.6	12.8	30.7	19.3	24.0	21.8	35.2
1897	24.5	11.8	29.0	17.6	17.6	19.4	33.9
1898	21.6	14.9	32.2	22.0	23.6	23.3	37.4
1899	25.5	11.1	33.8	24.9	24.0	22.7	35.7
1900	20.4	11.4	33.4	20.2	20.9	21.8	32.7
1901	25.6	11.2	33.3	22.5	20.0	21.1	32.7
1902	29.0	15.6	35.1	24.5	24.7	24.5	36.9
1903	26.4	15.5	36.2	24.7	25.1	25.2	33.4
1904	27.2	14.4	33.6	22.9	19.8	22.0	32.2
1905	26.8	14.3	33.3	24.0	24.2	23.4	35.9
Average	25.1	13.3	33.1	22.3	22.4	22.5	34.6

[a] Winchester bushels. [b] Bushels of 48 pounds.

Wholesale prices of barley per bushel in leading cities of the United States, 1902–1906.

Date.	Cincinnati. Extra No. 3 spring.		Chicago. No. 3.		St. Louis. Malting, medium to choice.		Minneapolis.		San Francisco. No. 1 brewing per cwt.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
January	67	70	57	65½	59	67	54	62	$0.80	$0.95
February	67	69	58	64	59	66	51	63	.90	1.02½
March	67	70	58	67	56	67	51	64	.92½	1.02½
April	68	74	61	70	57	68	52	66	.93¾	1.02½
May	67	69	64	72	60	70	56	70	.95	1.07½
June	67	69	64	71	......	......	50	67	.92½	1.01¼
July	......	......	48	73	......	......	41	52	.92½	1.00
August	......	......	41	65	......	......	35	63	.93¾	1.01¼
September	55	65	38	63	52	67	35	62	.96¼	1.15
October	55	65	35	60	50	62	32	69	1.12½	1.25
November	55	65	35	58	48	61	30	60	1.18¾	1.30
December	55	65	36	70	48	61	30	60	1.22½	1.32½
1903.									No. 1 feed.	
January	55	65	45	58	50	61	35	62	1.15	1.21¼
February	56	65	47	56	50	61	42	60	1.15	1.22½
March	56	65	46	55	50	61	40	58	1.11¼	1.20
April	55	62	46	55	48	57	40	52	1.05	1.16¼
May	55	62	48	56	48	57	40	52	1.05	1.12½
June	55	62	49	54	......	......	40	52	.90	1.12½
July	......	......	47	53	......	......	34	57	.97½	1.10
August	......	......	47	57	......	......	34	55	1.02½	1.13¾
September	62	71	51	63	55	67	40	57	1.05¾	1.16¼
October	61	69	46	62	54	65	35	55	1.05¾	1.16¼
November	62	69	43	61½	50	64	33	57	1.11¼	1.15
December	60	69	42	61½	49	63	30	55	1.07½	1.15
1904.										
January	60	69	37	61	48	65	32	57	1.10	1.13¾
February	62	69	40	61	50	65	36	55	1.07½	1.15
March	62	69	40	54	48	64	34	54	1.06¼	1.15
April	62	69	38	60	49	62	33	52	1.07½	1.15
May	62	69	38	59	......	......	33	52	1.05¾	1.10
June	62	69	35	59	......	......	32	52	.95	1.06¼
July	......	......	36	55	......	......	28	50	.95	1.03¾
August	......	......	38	55	42	48	30	53	1.03¾	1.10
September	......	......	38	55	50	59	33	56	1.05	1.12½
October	55	62	37	54	45	59	32	47	1.07½	1.12½
November	55	60	38	53	45	54	32	46	1.07½	1.13¾
December	55	60	38	52	44	54	33	48	1.10	1.15
1905.										
January	52	58	38	50	44	53	33	45	1.16¼	1.23¾
February	52	58	37	48	45	53	36	45	1.22½	1.25
March	52	58	40	48	45	51	37	44	1.22½	1.30
April	52	58	40	49½	47	48	36	44	1.22½	1.30
May	54	58	40	50	......	......	37	46	1.22½	1.35
June	54	58	43	50	......	......	39	46	1.27½	1.35

Wholesale prices of barley per bushel in leading cities of the United States. 1902–1906—Continued.

Date.	Cincinnati.		Chicago.		St. Louis.		Minneapolis.		San Francisco.	
	Extra No. 3. spring.		No. 3.		Malting, medium to choice.				No. 1, feed (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1905.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*		
July	54	58	40	52	......	......	35	48	$1.10	$1.30
August	54	58	37½	50	......	......	30	48	1.02½	1.10
September	54	58	37½	52	48	55	32	47	1.05	1.13¾
October	54	58	36½	53	43	55	32	48	1.10	1.30
November	54	58	37½	55	43	56	34	48	1.22½	1.27½
December	54	58	37	53	45	54	34	48	1.22½	1.27½
1906.										
January	53	58	38½	55	46	53½	......	......	......	......
February	53	58	38	51	45	52	......	......	......	......
March	53	58	39	53	45	53½	......	......	......	......
April	55	60	39	53	a 41½	a 42	......	......	......	......
May	55	60	42	55½	a 46	a 47	......	......	......	......
June	55	60	43	58	a 47	a 51	......	......	......	......
July	55	60	40	54	a 41	a 45	......	......	......	......
August	......	......	38	53	a 36	a 38	......	......	......	......
September	52	61	38	55	46	57	......	......	......	......
October	52	61	40	56	45	58	......	......	......	......
November	56	62	42	56	46	58	......	......	......	......
December	57	62	44	56	49	58½	......	......	......	......

a Feed barley.

RYE.

Rye crop of countries named, 1902–1906.

[Substantially the crop of the world.]

Country.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	33,631,000	29,363,000	27,242,000	28,486,000	33,375,000
Canada:					
Ontario	3,620,000	3,064,000	2,065,000	1,769,000	1,369,000
Manitoba	51,000	51,000	130,000	179,000	104,000
Other	800,000	800,000	800,000	800,000	800,000
Total Canada	4,471,000	3,915,000	2,995,000	2,748,000	2,273,000
Mexico	100,000	136,000	67,000	60,000	60,000
Total North America	38,202,000	33,414,000	30,304,000	31,294,000	35,708,000
EUROPE.					
Austria-Hungary:					
Austria	82,482,000	81,130,000	91,685,000	98,192,000	99,246,000
Hungary proper	49,458,000	47,355,000	43,880,000	54,089,000	51,962,000
Croatia-Slavonia	3,049,000	3,386,000	2,038,000	2,537,000	2,409,000
Bosnia-Herzegovina	257,000	396,000	360,000	374,000	395,000
Total Austria-Hungary	135,246,000	132,267,000	137,963,000	155,192,000	154,012,000
Belgium	22,374,000	21,756,000	21,988,000	21,349,000	22,000,000
Bulgaria	8,000,000	7,750,000	7,772,000	7,541,000	10,818,000
Denmark	18,779,000	19,305,000	16,546,000	19,245,000	19,000,000
Finland	8,841,000	10,598,000	10,362,000	9,000,000	10,000,000
France	47,051,000	57,951,000	52,141,000	58,116,000	51,095,000
Germany	373,768,000	389,923,000	396,075,000	378,204,000	378,948,000
Italy	3,200,000	4,000,000	3,000,000	4,000,000	4,000,000
Netherlands	13,971,000	13,973,000	13,517,000	13,742,000	14,000,000
Norway	776,000	857,000	717,000	982,000	800,000
Roumania	6,958,000	7,145,000	2,201,000	7,344,000	8,900,000

Rye crop of countries named, 1902–1906—Continued.

Country.	1902.	1903.	1904.	1905.	1906.
EUROPE—continued.					
Russia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Russia proper	810,537,000	803,296,000	893,205,000	629,671,000	568,200,000
Poland	75,257,000	69,100,000	76,606,000	69,088,000	63,800,000
Northern Caucasia	8,654,000	7,498,000	8,179,000	9,950,000	6,400,000
Total Russia (European)	894,448,000	879,894,000	977,990,000	708,709,000	638,400,000
Servia	1,084,000	1,091,000	1,031,000	1,103,000	1,560,000
Spain	26,187,000	22,511,000	14,185,000	26,500,000	31,828,000
Sweden	22,293,000	23,360,000	20,708,000	24,393,000	26,247,000
United Kingdom	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Total Europe	1,584,976,000	1,594,381,000	1,678,196,000	1,437,420,000	1,373,608,000
ASIA.					
Russia:					
Central Asia	1,489,000	1,066,000	1,088,000	690,000	600,000
Siberia	23,080,000	30,982,000	29,360,000	28,043,000	29,900,000
Total Russia (Asiatic)	24,569,000	32,048,000	30,448,000	28,733,000	30,500,000
Total Asia	24,569,000	32,048,000	30,448,000	28,733,000	30,500,000
AUSTRALASIA.					
Australia:					
Queensland		7,000	2,000	1,000	2,000
New South Wales	39,000	35,000	83,000	35,000	51,000
Victoria	15,000	22,000	31,000	32,000	30,000
Western Australia	3,000	5,000	4,000	5,000	5,000
Tasmania	13,000	9,000	11,000	12,000	11,000
Total Australian Commonwealth	70,000	78,000	131,000	85,000	99,000
New Zealand	28,000	40,000	21,000	33,000	65,000
Total Australasia	98,000	118,000	152,000	118,000	164,000
Grand total	1,647,845,000	1,659,961,000	1,739,100,000	1,497,565,000	1,439,980,000

Visible supply of rye in the United States and Canada, first of each month, for ten years.[a]

Month.	1897–98.	1898–99.	1899–1900.	1900–1901.	1901–2.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	2,464,000	988,000	904,000	806,000	747,000
August	1,946,000	365,000	638,000	725,000	753,000
September	2,499,000	721,000	647,000	1,056,000	1,864,000
October	3,064,000	894,000	962,000	1,216,000	2,440,000
November	3,832,000	1,260,000	1,906,000	1,513,000	2,863,000
December	3,932,000	1,212,000	1,892,000	1,754,000	3,463,000
January	4,436,000	1,573,000	1,806,000	1,651,000	3,257,000
February	4,291,000	1,576,000	1,734,000	1,530,000	3,270,000
March	4,099,000	1,724,000	1,951,000	1,532,000	2,972,000
April	3,682,000	1,658,000	1,566,000	1,333,000	2,639,000
May	3,039,000	1,335,000	1,441,000	1,112,000	1,910,000
June	1,526,000	975,000	1,206,000	938,000	950,000

Month.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
July	442,000	926,000	938,000	920,000	1,544,000
August	328,000	867,000	968,000	823,000	1,480,000
September	903,000	866,000	1,233,000	1,081,000	1,629,000
October	1,362,000	1,259,000	1,686,000	1,627,000	1,793,000
November	1,828,000	1,509,000	2,055,000	2,251,000	1,906,000
December	2,159,000	1,744,000	2,525,000	2,703,000	1,891,000
January	2,454,000	1,835,000	2,504,000	2,990,000	2,038,000
February	2,354,000	1,746,000	2,259,000	2,857,000	2,001,000
March	2,273,000	1,717,000	1,961,000	2,723,000	1,871,000
April	1,688,000	1,483,000	1,554,000	2,452,000	1,637,000
May	1,879,000	1,554,000	1,336,000	1,954,000	1,416,000
June	2,027,000	1,186,000	1,064,000	1,734,000	....

[a] These figures represent stocks available at 62 of the principal points of accumulation east of the Rocky Mountains, stocks in Manitoba elevators, and stocks afloat on lakes and canals, as reported by Bradstreet's.

Acreage, production, value, prices, and exports of rye of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.	Chicago cash price per bushel, No. 2. December. Low.	Chicago cash price per bushel, No. 2. December. High.	Chicago cash price per bushel, No. 2. May of following year. Low.	Chicago cash price per bushel, No. 2. May of following year. High.	Domestic exports, including rye flour, fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*
1866	1,548,033	13.5	20,864,944	82.2	17,149,716	......	......	142	150	234,971
1867	1,689,175	13.7	23,184,000	100.4	23,280,584	132	157	173	185	564,901
1868	1,651,321	13.6	22,504,800	94.9	21,349,190	106½	118	100	115½	92,869
1869	1,657,584	13.6	22,527,900	77.0	17,341,861	66	77½	78	83½	199,450
1870	1,176,137	13.2	15,473,600	73.2	11,326,967	67	74	81	91	87,174
1871	1,069,531	14.4	15,365,500	71.1	10,927,623	62	63¾	75	93	832,689
1872	1,048,654	14.2	14,888,600	67.6	10,071,061	57½	70	68½	70	611,749
1873	1,150,355	13.2	15,142,000	70.3	10,638,258	70	81	91	102	1,923,404
1874	1,116,716	13.4	14,990,900	77.4	11,610,339	93	99½	103	107½	267,058
1875	1,359,788	13.0	17,722,100	67.1	11,894,223	67	68¾	61½	70½	589,159
1876	1,468,374	13.9	20,374,800	61.4	12,504,970	65½	73	70	92½	2,234,856
1877	1,412,902	15.0	21,170,100	57.6	12,201,759	55½	56½	54	60	4,249,684
1878	1,622,700	15.9	25,842,790	52.5	13,566,002	44	44½	47	52	4,877,821
1879	1,625,450	14.5	23,639,460	65.6	15,507,431	73½	81	73½	85	2,943,894
1880	1,767,619	13.9	24,540,829	75.6	18,564,560	82	91½	115	118	1,955,155
1881	1,789,100	11.6	20,704,950	93.3	19,327,415	96½	98	77	83	1,003,609
1882	2,227,894	13.4	29,960,037	61.5	18,439,194	57	58½	62	67	2,206,212
1883	2,314,754	12.1	28,058,582	58.1	16,300,503	56½	60	60½	62½	6,247,590
1884	2,343,963	12.2	28,640,000	51.9	14,857,040	51	52	68	73	2,974,390
1885	2,129,301	10.2	21,756,000	57.9	12,594,820	58½	61	58	61	216,699
1886	2,129,918	11.5	24,489,000	53.8	13,181,330	53	54½	54½	56½	377,302
1887	2,053,447	10.1	20,693,000	54.5	11,283,140	55½	61½	63	68	94,827
1888	2,364,805	12.0	28,415,000	58.8	16,721,869	50	52	39	41½	309,266
1889	2,171,493	13.1	28,420,299	42.3	12,009,752	44	45½	49½	54	2,280,975
1890	2,141,853	12.0	25,807,472	62.9	16,229,992	64½	68½	83	92	358,263
1891	2,176,466	14.6	31,751,868	77.4	24,589,217	86	92	70¼	79	12,068,628
1892	2,163,657	12.9	27,894,037	54.2	15,103,901	46	51	50½	62	1,493,924
1893	2,038,485	13.0	26,555,446	51.3	13,612,222	45	47½	44½	48	249,152
1894	1,944,780	13.7	26,727,615	50.1	13,395,476	47½	49	62½	67	32,045
1895	1,890,345	14.4	27,210,070	44.0	11,964,826	32	35¾	33	36½	1,011,128
1896	1,831,201	13.3	24,369,047	40.9	9,960,769	37	42½	32¾	35½	8,575,663
1897	1,703,561	16.1	27,363,324	44.7	12,239,647	45¾	47	48	75	15,562,035
1898	1,643,207	15.6	25,657,522	46.3	11,875,350	52½	55½	56½	62	10,169,822
1899	1,659,308	14.4	23,961,741	51.0	12,214,118	49	52	53	56¼	2,382,012
1900	1,591,362	15.1	23,995,927	51.2	12,295,417	45¾	49¾	51½	54	2,345,512
1901	1,987,505	15.3	30,344,830	55.7	16,909,742	59	65¾	54½	58	2,712,077
1902	1,978,548	17.0	33,630,592	50.8	17,080,793	48	49¾	48	50½	5,445,273
1903	1,906,894	15.4	29,363,416	54.5	15,993,871	50½	52½	69¾	78	784,068
1904	1,792,673	15.2	27,241,515	68.8	18,748,323	73	75	70	84	29,749
1905	1,730,159	16.5	28,485,952	61.1	17,414,138	64	68	58	62	1,387,826
1906	2,001,904	16.7	33,374,833	58.9	19,671,243	61	65	......	......	....

Acreage, production, and value of rye in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
Vermont	1,754	17.4	30,520	62	18,922
Massachusetts	3,977	15.0	59,655	65	38,776
Connecticut	10,569	18.0	190,242	66	125,560
New York	138,081	17.6	2,430,226	65	1,579,647
New Jersey	78,363	17.2	1,347,844	61	822,185
Pennsylvania	346,265	17.4	6,025,011	64	3,856,007
Delaware	1,037	15.0	15,555	64	9,955
Maryland	19,704	14.7	289,649	60	173,789
Virginia	16,407	13.4	219,854	70	153,898
West Virginia	11,336	12.2	138,299	70	96,809
North Carolina	15,427	11.0	169,697	85	144,242
South Carolina	4,015	8.5	34,128	125	42,660
Georgia	14,206	8.3	117,910	105	123,806
Ohio	52,000	19.5	1,014,000	57	577,980
Indiana	65,000	17.0	1,105,000	58	640,900
Illinois	64,324	17.0	1,093,508	56	612,364
Michigan	400,000	14.5	5,800,000	59	3,422,000
Wisconsin	267,427	17.0	4,546,259	58	2,636,830
Minnesota	88,448	19.3	1,707,046	50	853,523
Iowa	52,711	18.6	980,425	50	490,212
Missouri	18,000	15.8	284,400	60	170,640

Acreage, production, and value of rye in the United States in 1906, by States—Continued.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
North Dakota	23,200	18.7	433,840	47	203,905
South Dakota	33,084	18.8	621,979	45	279,891
Nebraska	95,000	21.0	1,995,000	44	877,800
Kansas	64,142	16.0	1,026,272	50	513,136
Kentucky	10,675	15.2	162,260	70	113,582
Tennessee	10,036	13.0	130,468	74	96,546
Alabama	1,673	12.5	20,912	105	21,958
Texas	4,728	14.6	69,029	85	58,675
Oklahoma	2,955	13.9	41,074	57	23,412
Arkansas	1,971	12.0	23,652	83	19,631
Montana	2,021	20.5	41,430	66	27,344
Wyoming	428	19.0	8,132	72	5,855
Colorado	2,179	20.0	43,580	56	24,405
Utah	3,775	24.0	90,600	65	58,890
Idaho	1,575	25.2	39,690	60	23,814
Washington	2,678	19.6	52,489	65	34,118
Oregon	10,049	17.2	172,843	74	127,904
California	62,684	12.8	802,355	71	569,672
United States	2,001,904	16.7	33,374,833	58.9	19,671,243

Condition of the rye crop of the United States, monthly, 1888–1907.

Year.	December of previous year.	April.	May.	June.	July.	August.	When harvested.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1888	96.0	93.5	92.9	93.9	95.1	91.4	92.8
1889	97.2	93.9	96.5	95.2	96.7	95.4	91.6
1890	96.4	92.8	93.5	92.3	92.0	86.8	85.4
1891	99.0	95.4	97.2	95.4	93.9	89.6	95.1
1892	88.8	87.0	88.9	91.0	92.8	89.8	88.5
1893	89.4	85.7	82.7	84.6	85.3	78.5	82.0
1894	94.6	94.4	90.7	93.2	87.0	79.8	86.9
1895	96.2	87.0	88.7	85.7	80.7	84.0	83.7
1896	94.9	82.9	87.7	85.2	83.8	88.0	82.0
1897	99.8	88.9	88.0	89.9	93.4	89.8	90.1
1898	....	92.1	94.5	97.1	94.6	93.7	89.4
1899	98.9	84.9	85.2	84.5	84.9	89.0	82.0
1900	98.2	84.8	88.5	87.6	84.0	76.0	84.2
1901	99.1	93.1	94.1	93.9	93.5	83.6	84.9
1902	89.9	85.4	83.4	88.1	90.3	90.5	90.2
1903	98.1	97.9	93.3	90.6	89.3	87.2	84.1
1904	92.7	82.3	81.2	86.3	89.1	91.8	86.9
1905	90.5	92.1	93.5	95.3	92.9	92.6	90.8
1906	95.4	90.9	93.0	89.9	91.3	90.8	90.5
1907	96.2	92.0	88.0	....	....	....	....

Average yield of rye in certain countries, in bushels per acre, 1896–1905.

Year.	United States.	Russia.	Germany.	Austria.	Hungary.	France.	Ireland.
	(a)	(b)	(b)	(b)	(b)	(a)	(b)
1896	13.3	10.9	22.7	16.3	18.2	18.7	25.4
1897	16.1	9.3	21.8	13.9	13.5	13.4	21.6
1898	15.6	10.5	24.2	17.7	16.9	18.3	25.8
1899	14.4	12.8	23.6	18.7	17.7	18.2	25.8
1900	15.1	12.5	22.9	13.0	15.1	16.9	25.6
1901	15.3	14.0	22.4	16.9	15.8	16.7	27.4
1902	17.0	12.5	24.5	18.2	19.1	14.3	28.0
1903	15.4	12.2	26.3	18.2	18.2	18.1	26.9
1904	15.2	13.7	26.3	19.3	17.1	16.6	26.0
1905	16.5	10.1	24.9	20.2	19.2	18.5	27.0
Average	15.4	11.8	24.0	17.2	17.1	17.0	26.0

[a] Winchester bushels. [b] Bushels of 56 pounds.

Average yield per acre of rye in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	13.5	18.0	15.0	17.2	......	......	......	......	......	......
New Hampshire	18.0	17.5	15.0	17.1	......	......	......	......	......	......
Vermont	16.0	19.1	17.0	16.6	18.3	16.9	19.4	16.9	15.0	17.4
Massachusetts	19.5	16.7	16.0	16.9	15.9	15.2	13.7	17.0	15.5	15.0
Connecticut	19.0	18.0	18.0	17.0	18.0	17.4	17.0	16.9	18.0	18.0
New York	18.5	17.5	16.0	15.1	14.9	17.5	15.2	14.8	16.0	17.6
New Jersey	17.0	15.5	15.0	15.9	15.0	16.4	13.8	17.5	18.0	17.2
Pennsylvania	19.0	16.1	15.0	15.3	15.9	16.0	15.6	15.5	17.0	17.4
Delaware	......	......	......	......	15.3	13.5	14.8	11.8	10.0	15.0
Maryland	17.0	14.5	14.0	16.5	14.4	14.0	13.7	14.8	14.5	14.7
Virginia	11.0	11.2	9.0	10.5	11.1	9.6	12.2	15.7	11.8	13.4
West Virginia	11.5	11.2	10.0	10.5	12.0	8.1	11.5	12.5	11.8	12.2
North Carolina	8.8	9.1	7.0	8.9	8.5	8.2	8.8	9.9	9.5	11.0
South Carolina	6.6	8.5	5.0	7.5	7.7	7.6	7.6	7.5	8.1	8.5
Georgia	7.4	8.0	6.0	7.0	7.6	6.3	7.9	8.3	7.7	8.3
Ohio	18.0	17.4	16.0	16.6	16.9	17.5	15.3	16.1	18.0	19.5
Indiana	13.0	15.5	13.0	15.1	14.5	14.5	12.6	14.6	15.4	17.0
Illinois	15.5	14.8	15.0	17.2	17.0	19.1	16.5	17.6	18.0	17.0
Michigan	15.0	15.3	14.0	14.6	14.0	17.9	15.5	13.2	16.0	14.5
Wisconsin	16.0	15.3	15.0	15.8	15.9	18.9	16.6	16.2	16.5	17.0
Minnesota	17.2	20.5	18.0	19.5	19.3	22.3	18.4	17.7	18.2	19.3
Iowa	16.0	19.0	18.0	18.0	18.4	17.4	16.9	17.2	17.5	18.6
Missouri	12.0	13.1	13.0	14.0	14.2	18.2	12.8	14.4	15.5	15.8
North Dakota	14.5	15.0	15.0	5.2	13.8	20.2	15.7	18.5	19.5	18.7
South Dakota	16.5	16.6	15.0	10.6	14.4	18.8	20.2	16.5	19.0	18.8
Nebraska	17.0	18.8	16.0	14.2	15.0	20.3	14.2	15.8	18.0	21.0
Kansas	14.0	15.6	11.0	15.2	14.3	12.0	16.2	13.2	15.7	16.0
Kentucky	13.0	13.0	10.0	13.1	14.0	13.4	11.6	13.7	15.0	15.2
Tennessee	10.0	10.5	9.0	11.0	11.3	11.0	13.4	11.7	12.1	13.0
Alabama	9.6	11.1	8.0	7.8	8.0	10.0	10.6	10.4	11.7	12.5
Texas	12.0	12.0	10.0	16.5	11.1	9.9	14.2	13.1	14.0	14.6
Oklahoma	......	......	......	......	14.8	16.0	17.9	9.4	12.1	13.9
Arkansas	11.0	11.4	11.0	11.5	8.7	12.3	9.7	11.1	12.0	12.0
Montana	......	......	......	......	26.7	25.0	24.6	19.9	20.0	20.5
Wyoming	......	......	......	......	24.0	18.0	18.0	19.5	23.0	19.0
Colorado	15.0	18.0	14.0	16.8	16.1	15.9	18.3	19.1	19.0	20.0
Utah	12.0	19.5	17.0	17.5	14.2	12.4	16.1	16.0	18.0	24.0
Idaho	......	......	......	......	15.0	20.2	18.5	19.7	25.0	25.2
Washington	19.5	18.0	16.0	16.3	17.5	17.8	21.0	19.0	18.5	19.6
Oregon	15.0	14.4	11.0	16.1	15.7	13.4	14.2	14.4	15.0	17.2
California	12.2	9.0	15.0	13.0	12.8	12.0	12.3	7.6	13.0	12.8
General average	16.1	15.6	14.4	15.1	15.3	17.0	15.4	15.2	16.5	16.7

Average value per acre of rye in the United States, based upon farm value, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$11.07	$15.12	$12.60	$14.10	......	......	......	......	......	......
New Hampshire	15.12	13.12	12.15	14.02	......	......	......	......	......	......
Vermont	9.60	11.08	10.54	10.13	$14.64	$13.01	$12.61	$12.51	$9.75	$10.79
Massachusetts	11.90	10.52	12.64	12.68	12.56	12.16	10.00	13.94	12.25	9.75
Connecticut	11.21	10.80	11.52	11.05	12.96	13.05	12.07	13.35	13.32	11.88
New York	8.88	8.75	8.96	8.46	9.24	10.15	9.27	10.80	10.72	11.44
New Jersey	8.50	7.75	8.25	8.74	8.85	10.00	8.83	12.25	11.88	10.49
Pennsylvania	8.17	7.57	7.65	8.11	9.54	8.48	9.67	11.01	11.05	11.14
Delaware	......	......	......	......	8.87	8.37	9.03	8.61	6.60	9.60
Maryland	7.82	7.83	7.98	8.58	8.06	8.12	8.08	11.25	9.43	8.82
Virginia	5.50	5.15	4.77	6.09	6.77	6.34	8.05	11.62	8.38	9.38
West Virginia	5.87	5.82	6.20	6.72	7.80	5.51	8.17	9.63	8.26	8.54
North Carolina	5.28	5.82	5.25	6.76	6.63	6.97	7.39	8.61	8.17	9.35
South Carolina	5.68	8.67	5.45	7.87	8.55	8.59	8.13	9.45	9.64	10.63
Georgia	6.81	7.84	6.72	7.21	8.06	6.93	9.01	8.47	8.39	8.72
Ohio	7.92	7.83	8.80	9.13	9.30	9.27	8.87	11.91	11.16	11.12
Indiana	5.46	6.67	6.24	7.55	7.68	6.67	6.68	10.07	9.24	9.86
Illinois	6.82	6.51	7.05	8.08	9.69	9.55	8.58	12.32	10.80	9.52
Michigan	6.30	6.58	7.28	7.01	7.28	8.77	7.90	9.50	9.44	8.56
Wisconsin	6.56	6.58	7.20	7.74	8.27	9.45	8.30	11.18	9.73	9.86
Minnesota	6.36	7.79	7.56	8.19	9.46	9.59	8.28	11.33	9.65	9.65
Iowa	5.76	7.60	7.20	7.38	9.20	7.31	7.44	10.32	9.27	9.30
Missouri	5.28	6.16	6.50	7.14	9.51	8.74	7.04	9.22	9.61	9.48
North Dakota	5.22	5.40	5.55	2.13	5.93	8.69	6.75	11.10	9.75	8.79
South Dakota	5.78	5.64	5.55	4.13	6.19	7.71	8.08	9.41	9.31	8.46
Nebraska	5.44	6.39	6.08	5.68	6.90	7.31	5.25	8.69	8.64	9.24
Kansas	5.60	5.77	4.62	6.54	7.87	5.40	7.13	8.58	8.48	8.00

Average value per acre of rye in the United States, based upon farm value, December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Kentucky	$6.89	$7.15	$7.00	$8.25	$9.58	$8.31	$8.00	$10.96	$10.65	$10.64
Tennessee	5.80	5.56	6.03	7.48	8.36	8.03	9.92	9.24	9.32	9.62
Alabama	11.33	11.65	8.32	8.03	8.32	10.50	11.45	12.48	13.34	13.12
Texas	8.64	8.52	8.20	11.05	10.32	7.52	10.51	11.27	11.90	12.41
Oklahoma	......	......	......	......	10.36	7.52	8.95	5.83	7.50	7.92
Arkansas	9.46	7.41	8.14	8.28	7.74	8.98	8.15	9.77	11.16	9.96
Montana	......	......	......	......	16.02	16.00	15.50	15.32	13.00	13.53
Wyoming	......	......	......	......	19.20	9.00	12.42	7.80	14.26	13.68
Colorado	7.80	9.00	6.72	9.07	9.98	8.90	11.16	12.41	10.64	11.20
Utah	7.20	8.97	8.16	9.10	9.23	7.56	10.46	10.72	11.70	15.60
Idaho	......	......	......	......	10.05	12.12	12.02	14.77	14.00	15.12
Washington	12.09	10.44	9.60	9.45	10.85	11.39	15.12	15.01	12.95	12.74
Oregon	8.85	10.37	7.70	9.82	10.36	9.78	13.77	12.82	12.15	12.73
California	7.93	6.30	11.70	7.54	7.30	9.00	9.47	5.93	10.01	9.09
General average	7.18	7.23	7.36	7.73	8.51	8.63	8.39	10.46	10.07	9.83

Average farm price of rye per bushel in the United States, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Maine	82	84	84	82	......	......	......	......	......	......
New Hampshire	84	75	81	82	......	......	......	......	......	......
Vermont	60	58	62	61	80	77	65	74	65	62
Massachusetts	61	63	79	75	79	80	73	82	79	65
Connecticut	59	60	64	65	72	75	71	79	74	66
New York	48	50	56	56	62	58	61	73	67	65
New Jersey	50	50	55	55	59	61	64	70	66	61
Pennsylvania	43	47	51	53	60	53	62	71	65	64
Delaware	......	......	......	......	58	62	61	73	66	64
Maryland	46	54	57	52	56	58	59	76	65	60
Virginia	50	46	53	58	61	66	66	74	71	70
West Virginia	51	52	62	64	65	68	71	77	70	70
North Carolina	60	64	75	76	78	85	84	87	86	85
South Carolina	86	102	109	105	111	113	107	126	119	125
Georgia	92	98	112	103	106	110	114	102	109	105
Ohio	44	45	55	55	55	53	58	74	62	57
Indiana	42	43	48	50	53	46	53	69	60	58
Illinois	44	44	47	47	57	50	52	70	60	56
Michigan	42	43	52	48	52	49	51	72	59	59
Wisconsin	41	43	48	49	52	50	50	69	59	58
Minnesota	37	38	42	42	49	43	45	64	53	50
Iowa	36	40	40	41	50	42	44	60	53	50
Missouri	44	47	50	51	67	48	55	64	62	60
North Dakota	36	36	37	41	43	43	43	60	50	47
South Dakota	35	34	37	39	43	41	40	57	49	45
Nebraska	32	34	38	40	46	36	37	55	48	44
Kansas	40	37	42	43	55	45	44	65	54	50
Kentucky	53	55	70	63	67	62	69	80	71	70
Tennessee	58	53	67	68	74	73	74	79	77	74
Alabama	118	105	104	103	104	105	108	120	114	105
Texas	72	71	82	67	93	76	74	86	85	85
Oklahoma	......	......	......	......	70	47	50	62	62	57
Arkansas	86	65	74	72	89	73	84	88	93	83
Montana	......	......	......	......	60	64	63	77	65	66
Wyoming	......	......	......	......	80	50	69	40	62	72
Colorado	52	50	48	54	62	56	61	65	56	56
Utah	60	46	48	52	65	61	65	67	65	65
Idaho	......	......	......	......	67	60	65	75	56	60
Washington	62	58	60	58	62	64	72	79	70	65
Oregon	59	72	70	61	66	73	97	89	81	74
California	65	70	78	58	57	75	77	78	77	71
General average	44.7	46.3	51.0	51.2	55.7	50.8	54.5	68.8	61.1	58.9

Wholesale prices of rye per bushel in leading cities of the United States, 1902–1906.

Date.	Philadelphia.		Cincinnati. No. 2.		Chicago. No. 2.		Duluth.		San Francisco (per cwt.).	
	Low.	High.	Low	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	69	71	66	71½	56	67½	54	64	77½	90
February	68	70	64	67	56	60½	53	57½	87½	90
March	65	69	63	65	54½	58	52	54½	87½	95
April	64½	67	62	64	54½	57½	52	56	92½	95
May	64	66	60	63½	54½	58	54	57	92½	95
June	......	......	54	59	56¾	58	55¼	56½	92½	95
July	58	59	55½	58	52¼	61½	51¼	58	85	95
August	56	58½	51	56	48	54	46	51	85	90
September	57½	59	52½	55½	49	50½	47½	49	85	105
October	55½	58½	52	53	48	50½	47	49	102½	110
November	56	58½	51	54	48½	51½	49	49¾	105	110
December	54	58½	51	56	48	49¾	48	49¾	105	115
1903.										
January	57	61½	55½	59	48	50¼	48	49	112½	115
February	61	65½	57½	58½	48¾	51½	48	49	112½	117
March	61	63	56	58½	48¾	51½	49	49½	110	117½
April	59	60¾	55	58	48	51	49	50½	110	115
May	58	60	54	58	48	50½	49½	50	110	115
June	56	58	57	58	49	53¾	50	52	110	116¼
July	58½	60¼	56	57½	49½	51½	48½	50½	115	120
August	......	......	55	60	50½	53½	50½	52½	117½	125
September	62	65½	59½	63	53	60	50½	55¼	120	130
October	64	66	61	63	53	56½	52	54	125	130
November	63½	68	58	62	51½	58¼	52	54	125	130
December	67½	68½	59	62½	50½	52½	51	52½	125	130
1904.										
January	69	72	61	64	51	57	54½	57	125	130
February	72	74	63	81	56	77	58	73	127	135
March	......	......	76	80	66½	76	63	71	130	135
April	......	......	74	78	66	72	64	68½	130	135
May	......	......	75	80	69¾	78	65	69	130	135
June	78	80	76	80	63½	75	55	67	130	135
July	65	72	73	78	63	75	55	80	125	130
August	......	......	70	76½	62	76	62	75	125	132½
September	85	87½	75	83	69½	75	72	77	127½	140
October	88½	96	81	87	75	79½	77	79¼	137½	140
November	89	91	83	87	76	81	74	80	137½	145
December	80½	87½	81	86	73	75	71	74	140	147½
1905.										
January	81	87½	80	86	74½	75½	72½	75	142½	150
February	80	90¼	81½	86	74	78	73	75	145	160
March	80	83½	84	87	75	78½	73½	78	150	160
April	79½	83	80	86	73	78½	74	77	150	165
May	......	......	80	83	70	84	70	78	155	165
June	72	75	80	83	75	79	70	78	160	175
July	63	66	60	83	58	75	57½	72	140	150
August	65¾	69½	56	60	57½	60	55½	58	147½	152½
September	70	76½	56	66	60	72	59	64	150	152½
October	73¼	76	67	74	67	73½	63	65	145	152½
November	68	73	70	74½	66	72½	62	66½	145	147½
December	66½	73	70	72	64	68	62	60	145	150
1906.										
January	65	67	68	70½	65	68	60	60	......	......
February	63	65	65	70	63	65	60	61	......	......
March	58½	63	66	70	58½	63	56	59	......	......
April	58	62½	66	70	58	62½	56	57	......	......
May	58	62	66	69	58	62	57	57	......	......
June	60	61½	62	69	60	62	57	57	......	......
July	56	60	58	64	56	60	53	57	......	......
August	55½	56½	58	62	55½	56½	53	53	......	......
September	55½	62	60	66	55½	63	53	56	......	......
October	62	62½	65	68½	60	62½	56	59½	......	......
November	60	65	66½	72	60	65	58	61	......	......
December	61	65	69	72½	61	65	60	61	......	......

BUCKWHEAT.

Condition of the buckwheat crop of the United States, monthly, 1887–1906.

Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.	Year.	Aug.	Sept.	When harvested.
	P. ct.	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*
1887	93.3	89.1	76.6	1894	82.3	69.2	72.0	1901	91.1	90.9	90.5
1888	92.5	93.7	79.1	1895	85.2	87.5	84.8	1902	91.4	86.4	80.5
1889	95.2	92.1	90.0	1896	96.0	93.2	86.0	1903	93.9	91.0	83.0
1890	90.1	90.5	90.7	1897	94.9	95.1	90.8	1904	92.8	91.5	88.7
1891	97.3	96.6	92.7	1898	87.2	88.8	76.2	1905	92.6	91.8	91.6
1892	92.9	89.0	85.6	1899	93.2	75.2	70.2	1906	93.2	91.2	84.9
1893	88.8	77.5	73.5	1900	87.9	80.5	72.8				

Acreage, production, value, and prices of buckwheat in the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel, Dec. 1.	Farm value, Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
1866	1,045,624	21.8	22,791,839	67.6	15,413,160
1867	1,227,826	17.4	21,359,000	78.7	16,812,070
1868	1,113,993	17.8	19,863,700	78.0	15,490,426
1869	1,028,693	16.9	17,431,100	71.9	12,534,851
1870	536,992	18.3	9,841,500	70.5	6,937,471
1871	413,915	20.1	8,328,700	74.5	6,208,165
1872	448,497	18.1	8,133,500	73.5	5,979,222
1873	454,152	17.3	7,837,700	75.0	5,878,629
1874	452,590	17.7	8,016,600	72.9	5,843,645
1875	575,530	17.5	10,082,100	62.0	6,254,564
1876	666,441	14.5	9,668,800	66.6	6,435,836
1877	649,923	15.7	10,177,000	66.9	6,808,180
1878	673,100	18.2	12,246,820	52.6	6,441,240
1879	639,900	20.5	13,140,000	59.8	7,856,191
1880	822,802	17.8	14,617,535	59.4	8,682,488
1881	828,815	11.4	9,486,200	86.5	8,205,705
1882	847,112	13.0	11,019,353	73.0	8,038,862
1883	857,349	8.9	7,668,954	82.2	6,303,980
1884	879,403	12.6	11,116,000	58.9	6,549,020
1885	914,394	13.8	12,626,000	55.9	7,057,363
1886	917,915	12.9	11,869,000	54.5	6,465,120
1887	910,506	11.9	10,[illegible]44,000	56.5	6,122,320
1888	912,630	13.2	12,050,000	63.3	7,627,647
1889	837,162	14.5	12,110,329	50.5	6,113,119
1890	844,579	14.7	12,432,831	57.4	7,132,872
1891	849,364	15.0	12,760,932	57.0	7,271,506
1892	861,451	14.1	12,143,185	51.8	6,295,643
1893	815,614	14.9	12,122,311	58.4	7,074,450
1894	789,232	16.1	12,668,200	55.6	7,040,238
1895	763,277	20.1	15,341,399	45.2	6,936,325
1896	754,898	18.7	14,089,783	39.2	5,522,339
1897	717,836	20.9	14,997,451	42.1	6,319,188
1898	678,332	17.3	11,721,927	45.0	5,271,462
1899	670,148	16.6	11,094,473	55.7	6,183,675
1900	637,930	15.0	9,566,966	55.8	5,341,413
1901	811,164	18.6	15,125,939	56.3	8,523,317
1902	804,889	18.1	14,529,770	59.6	8,654,704
1903	804,393	17.7	14,243,644	60.7	8,650,733
1904	793,625	18.9	15,008,336	62.2	9,330,768
1905	760,118	19.2	14,585,082	58.7	8,565,499
1906	789,208	18.6	14,641,937	59.6	8,727,443

Acreage, production, and value of buckwheat in the United States in 1906, by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1	Farm value Dec. 1.
	Acres.	*Bush.*	*Bushels.*	*Cents.*	*Dollars.*
Maine	22,783	28.0	637,924	59	376,375
New Hampshire	1,874	22.0	41,228	73	30,096
Vermont	7,706	21.0	161,826	58	93,859
Massachusetts	2,359	20.0	47,180	68	32,082
Connecticut	3,350	17.0	56,950	75	42,712
New York	321,552	19.0	6,109,488	61	3,726,788
New Jersey	11,598	18.0	208,764	60	125,258
Pennsylvania	252,000	19.0	4,788,000	57	2,729,160
Delaware	1,331	17.0	22,627	61	13.802
Maryland	8,124	18.0	146,232	60	87,739
Virginia	18,078	19.0	343,482	58	199,220
West Virginia	21,131	18.0	380,358	65	247,233
North Carolina	5,603	14.0	78,442	64	50,203
Ohio	13,000	19.0	247,000	57	140,790
Indiana	4,315	16.0	69,040	64	44,186
Illinois	3,787	19.0	71,953	75	53,965
Michigan	52,000	13.0	676,000	55	371,800
Wisconsin	20,842	15.0	312,630	62	193,831
Minnesota	4,538	14.0	63,532	54	34,307
Iowa	9,000	12.0	108,000	76	82,080
Missouri	1,501	18.0	27,018	74	19,993
Nebraska	861	15.0	12,915	62	8,007
Kansas	1,348	17.0	22,916	74	16,958
Tennessee	527	16.0	8,432	83	6,999
United States	789.208	18.6	14,641,937	59.6	8,727,443

Average yield per acre of buckwheat in the United States, 1897–1906, by States.

State.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	35.0	26.5	22.0	30.0	31.7	30.4	29.8	32.5	30.0	28.0
New Hampshire	27.0	20.0	20.0	22.0	21.0	20.0	19.6	25.1	23.0	22.0
Vermont	24.0	21.4	23.0	25.0	25.1	25.0	24.0	26.3	19.0	21.0
Massachusetts	19.0	20.0	20.0	17.0	18.9	14.4	13.7	16.2	20.0	20.0
Connecticut	17.0	19.0	19.0	16.0	18.0	18.4	17.5	16.3	16.0	17.0
New York	22.0	16.8	13.0	14.0	18.8	17.7	18.3	18.8	19.0	19.0
New Jersey	16.0	21.0	21.0	16.0	19.0	22.5	18.1	20.8	21.0	18.0
Pennsylvania	21.0	17.2	20.0	14.0	19.5	18.1	16.5	18.8	20.0	19.0
Delaware	19.0	16.5	18.0	13.0	17.8	15.2	15.2	12.1	17.0	17.0
Maryland	19.0	12.2	13.0	15.0	17.5	17.0	16.3	18.2	19.0	18.0
Virginia	14.0	17.3	14.0	13.0	15.9	16.6	18.6	17.0	18.0	19.0
West Virginia	19.0	20.5	17.0	17.0	20.6	22.5	17.2	19.1	19.0	18.0
North Carolina	11.0	19.5	17.0	13.0	15.6	14.5	12.1	14.7	15.0	14.0
Ohio	18.0	20.0	16.0	16.0	16.1	13.9	16.6	16.9	17.0	19.0
Indiana	14.0	18.4	16.0	14.0	13.1	17.6	16.8	16.1	17.0	16.0
Illinois	13.0	14.0	15.0	15.0	11.0	15.5	15.3	17.9	16.0	19.0
Michigan	17.0	14.2	11.0	14.0	14.1	13.0	15.5	15.4	16.0	13.0
Wisconsin	18.0	15.5	15.0	14.0	12.4	16.0	15.6	17.7	15.0	15.0
Minnesota	17.0	15.0	17.0	15.0	14.5	13.9	15.2	15.1	14.0	14.0
Iowa	17.0	16.0	16.0	15.0	13.5	16.0	15.1	14.8	13.0	12.0
Missouri	15.0	15.8	14.0	13.0	6.0	16.0	14.8	13.5	16.0	18.0
North Dakota	......	......	......	......	11.5	10.0	12.7	13.5	......	......
Nebraska	14.0	12.8	16.0	16.0	11.5	14.7	19.0	14.7	14.0	15.0
Kansas	......	......	......	......	7.9	12.0	18.4	14.0	11.0	17.0
Tennessee	18.0	18.0	12.0	14.0	14.2	18.0	14.7	15.5	16.0	16.0
Oregon	18.0	14.0	17.0	13.0	......	......	......	......	......	......
General average	20.9	17.3	16.6	15.0	18.6	18.1	17.7	18.9	19.2	18.6

Average value per acre of buckwheat in the United States, based upon farm value December 1, 1897–1906, by States.

State.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$15.40	$10.34	$9.68	$14.70	$15.22	$15.81	$15.20	$16.90	$19.50	$16.52
New Hampshire	14.85	9.40	10.00	11.44	11.55	13.00	11.56	17.07	16.36	16.06
Vermont	11.04	9.84	11.96	12.50	14.81	14.00	13.20	14.73	9.69	12.18
Massachusetts	12.54	12.20	14.00	12.24	11.53	10.66	9.32	11.66	14.20	13.60
Connecticut	9.69	10.64	11.97	10.40	11.70	13.06	12.42	11.90	11.68	12.75
New York	8.80	7.56	7.67	7.98	10.72	10.44	10.80	11.47	11.21	11.59
New Jersey	7.84	11.34	11.76	9.44	9.88	14.40	11.58	13.73	13.23	10.80
Pennsylvania	8.82	7.57	10.80	7.70	10.92	11.04	10.56	11.84	11.20	10.83
Delaware	6.84	6.60	8.82	6.76	9.79	9.12	8.36	7.50	9.69	10.87
Maryland	9.69	6.47	7.28	8.55	10.50	10.37	10.27	11.47	11.97	10.80
Virginia	7.00	7.79	7.56	7.15	8.90	9.96	11.35	10.88	11.16	11.02
West Virginia	9.31	10.05	9.52	9.52	12.15	13.95	11.70	13.75	12.54	11.70
North Carolina	5.39	9.36	8.33	7.28	9.67	8.99	7.86	10.44	9.90	8.96
Ohio	9.00	10.20	9.28	9.28	9.66	8.48	10.79	12.17	10.54	10.83
Indiana	6.86	9.35	9.44	8.54	7.99	10.21	11.76	11.27	11.05	10.24
Illinois	7.41	7.28	8.70	9.75	7.70	11.01	11.17	13.96	10.88	14.25
Michigan	6.46	5.96	6.05	7.14	7.19	6.89	8.37	9.39	8.48	7.15
Wisconsin	6.84	6.20	9.45	8.26	7.32	9.44	9.32	11.15	8.46	9.30
Minnesota	7.62	7.35	8.84	8.55	8.99	7.92	8.06	9.05	7.98	7.56
Iowa	8.33	7.69	9.28	9.60	9.45	11.20	10.72	9.92	9.10	9.12
Missouri	9.06	9.48	8.54	8.97	4.56	9.84	11.10	11.48	13.12	13.32
North Dakota					6.90	5.40	6.78	9.45		
Nebraska	7.14	7.81	9.92	10.24	6.67	7.79	13.11	13.38	8.82	9.30
Kansas					5.92	9.00	14.35	11.20	7.59	12.58
Tennessee	10.26	9.36	6.84	8.26	8.38	13.68	9.70	11.01	10.88	13.28
Oregon	9.90	8.12	12.58	10.01						
General average	8.80	7.77	9.23	8.37	10.51	10.75	10.75	11.76	11.27	11.06

Average farm price of buckwheat per bushel in the United States December 1, 1897–1906, by States.

State.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Maine	44	39	44	49	48	52	51	52	65	59
New Hampshire	55	47	50	52	55	65	59	68	71	76
Vermont	46	46	52	50	59	56	55	56	51	58
Massachusetts	66	61	70	72	61	74	65	72	71	65
Connecticut	57	56	63	65	65	71	71	73	73	75
New York	40	45	59	57	57	59	59	61	59	61
New Jersey	49	54	56	59	52	64	64	66	63	60
Pennsylvania	42	44	54	55	56	61	64	63	56	57
Delaware	36	40	49	52	55	60	55	62	57	61
Maryland	51	53	56	57	60	61	63	63	63	60
Virginia	50	45	54	55	56	60	61	64	62	58
West Virginia	49	49	56	56	59	62	68	72	66	65
North Carolina	49	48	49	56	62	62	65	71	66	64
Ohio	50	51	58	58	60	61	65	72	62	57
Indiana	49	51	59	61	61	58	70	70	65	64
Illinois	57	52	58	65	70	71	75	78	68	75
Michigan	38	42	55	51	51	53	54	61	53	55
Wisconsin	38	40	63	59	59	59	61	63	56	62
Minnesota	45	49	52	57	62	57	53	60	57	54
Iowa	49	48	58	64	70	70	71	67	70	76
Missouri	60	60	61	69	76	58	75	85	82	74
North Dakota					60	54	56	70		
Nebraska	51	61	62	64	58	53	69	91	63	62
Kansas					75	75	78	80	69	74
Tennessee	57	52	57	59	59	76	66	71	68	83
Oregon	55	58	74	77						
General average	42.1	45.0	55.7	55.8	56.3	59.6	60.7	62.2	58.7	59.6

POTATOES.

Potato crop of countries named, 1901–1905.

[No statistics for Switzerland, Portugal, Argentina, Transvaal, Egypt, and some other less important potato-growing countries.]

Country.	1901.	1902.	1903.	1904.	1905.
NORTH AMERICA.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
United States	187,598,000	284,633,000	247,128,000	332,830,000	260,741,000
Canada:					
Ontario	18,688,000	13,350,000	17,202,000	15,967,000	14,819,000
Manitoba	4,949,000	3,568,000	4,907,000	3,919,000	4,910,000
New Brunswick	4,206,000	4,288,000	4,835,000	5,550,000	5,693,000
Other [a]	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000
Total Canada	57,843,000	51,206,000	56,944,000	55,436,000	55,422,000
Mexico	336,000	347,000	539,000	527,000	[b] 400,000
Newfoundland [a]	1,350,000	1,350,000	1,350,000	1,350,000	1,350,000
Total North America	247,127,000	337,536,000	305,961,000	390,143,000	317,913,000
SOUTH AMERICA.					
Chile	10,000,000	11,616,000	10,349,000	6,131,000	6,532,000
EUROPE.					
Austria-Hungary:					
Austria	437,110,000	428,229,000	357,121,000	398,298,000	581,822,000
Hungary proper	158,494,000	141,538,000	165,386,000	110,402,000	168,221,000
Croatia-Slavonia	17,512,000	13,059,000	19,337,000	9,311,000	[b] 15,000,000
Bosnia-Herzegovina	2,893,000	1,793,000	2,322,000	2,450,000	2,485,000
Total Austria-Hungary	616,009,000	584,619,000	544,166,000	520,461,000	767,528,000
Belgium	101,082,000	83,198,000	86,580,000	91,632,000	57,159,000
Denmark	22,002,000	27,168,000	25,256,000	24,214,000	29,953,000
Finland	16,325,000	15,298,000	19,212,000	15,465,000	16,500,000
France	411,055,000	441,534,000	450,262,000	451,039,000	[b] 438,000,000
Germany	1,788,950,000	1,596,969,000	1,576,361,000	1,333,326,000	1,775,579,000
Italy [c]	29,000,000	29,000,000	29,000,000	29,000,000	29,000,000
Malta	264,000	361,000	628,000	733,000	387,000
Netherlands	94,910,000	94,756,000	73,394,000	94,421,000	87,043,000
Norway	24,320,000	17,735,000	22,851,000	17,253,000	25,832,000
Roumania	3,819,000	4,659,000	5,246,000	3,001,000	3,733,000
Russia:					
Russia proper	566,926,000	723,435,000	675,330,000	705,170,000	686,502,000
Poland	287,712,000	288,447,000	194,829,000	179,997,000	331,529,000
Northern Caucasia	10,801,000	16,154,000	17,441,000	8,741,000	14,857,000
Total Russia (European)	865,439,000	1,028,036,000	887,600,000	893,908,000	1,032,888,000
Servia	1,237,000	1,402,000	1,527,000	718,000	1,232,000
Spain [b]	84,000,000	84,000,000	84,000,000	84,000,000	84,000,000
Sweden	43,793,000	51,377,000	59,317,000	51,314,000	74,819,000
United Kingdom:					
Great Britain	137,060,000	119,250,000	108,779,000	133,961,000	140,474,000
Ireland	125,896,000	101,761,000	88,227,000	98,635,000	127,793,000
Total United Kingdom	262,956,000	221,011,000	197,006,000	232,596,000	268,267,000
Total Europe	4,365,161,000	4,281,123,000	4,062,406,000	3,843,081,000	4,691,920,000
ASIA.					
Japan	10,153,000	7,418,000	9,824,000	11,274,000	[b] 10,000,000
Russia (Asiatic)	14,273,000	13,142,000	19,364,000	18,800,000	18,865,000
Total Asia	24,426,000	20,560,000	29,188,000	30,074,000	28,865,000
AFRICA.					
Algeria	1,673,000	1,851,000	1,596,000	1,655,000	[b] 1,700,000
Cape of Good Hope	[d] 1,600,000	[d] 1,600,000	[d] 1,600,000	1,942,000	[a] 2,000,000
Natal	316,000	433,000	345,000	451,000	466,000
Total Africa	3,589,000	3,884,000	3,541,000	4,048,000	4,166,000

[a] Estimated from returns for census year.
[b] Average production.
[c] Average, 1896-1900.
[d] Estimated from statistics for 1899 and 1904.

Potato crop of countries named, 1901–1905—Continued.

Country.	1901.	1902.	1903.	1904.	1905.
AUSTRALASIA.					
Australia:	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Queensland	747,000	836,000	122,000	659,000	718,000
New South Wales	2,361,000	1,461,000	1,147,000	2,118,000	1,820,000
Victoria	4,597,000	4,684,000	6,300,000	6,262,000	3,467,000
South Australia	544,000	562,000	1,057,000	1,173,000	729,000
Western Australia	181,000	214,000	242,000	170,000	210,000
Tasmania	3,504,000	4,282,000	6,105,000	6,395,000	4,127,000
Total Australian Commonwealth	11,934,000	12,039,000	14,973,000	16,777,000	11,071,000
New Zealand	7,721,000	7,215,000	7,795,000	5,025,000	5,025,000
Total Australasia	19,655,000	19,254,000	22,768,000	21,802,000	16,096,000
Grand total	4,669,958,000	4,673,973,000	4,434,213,000	4,295,279,000	5,065,492,000

Acreage, production, value, prices, exports, etc., of potatoes of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per bushel Dec. 1.	Farm value Dec. 1.	Chicago price per bushel, Burbank. December. Low.	December. High.	May of following year. Low.	May of following year. High.	Domestic exports, fiscal year beginning July 1.	Imports during fiscal year beginning July 1.
	Acres.	*Bush.*	*Bushels.*	*Cts.*	*Dollars.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Bushels.*	*Bushels.*
1866	1,069,381	100.2	107,200,976	47.3	50,722,553					512,380	198,265
1867	1,192,195	82.0	97,783,000	65.9	64,462,486					378,605	209,555
1868	1,131,552	93.8	106,090,000	59.3	62,918,660					508,249	138,470
1869	1,222,250	109.5	133,886,000	42.9	57,481,362					596,968	75,336
1870	1,325,119	86.6	114,775,000	65.0	74,621,018					553,070	458,758
1871	1,220,912	98.7	120,461,700	53.9	64,905,189					621,537	96,259
1872	1,331,331	85.3	113,516,000	53.5	60,692,129					515,306	346,840
1873	1,295,139	81.9	106,089,000	65.2	69,153,709					497,413	549,073
1874	1,310,041	80.9	105,981,000	61.5	65,223,914					609,642	188,757
1875	1,510,041	110.5	166,877,000	34.4	57,357,515					704,379	92,148
1876	1,741,983	71.7	124,827,000	61.9	77,319,541					529,650	3,205,555
1877	1,792,287	94.9	170,092,000	43.7	74,272,500					744,409	528,584
1878	1,776,800	69.9	124,126,650	58.7	72,923,575					625,342	2,624,149
1879	1,836,800	98.9	181,626,400	43.6	79,153,673					696,089	721,868
1880	1,842,510	91.0	167,659,570	48.3	81,062,214					638,840	2,170,372
1881	2,041,670	53.5	109,145,494	91.0	99,291,341					408,286	8,789,860
1882	2,171,636	78.7	170,972,508	5	95,304,844					439,443	2,362,362
1883	2,289,275	90.9	208,164,425	42.2	87,849,991					554,613	425,408
1884	2,220,980	85.8	190,642,000	39.6	75,524,290					380,868	658,633
1885	2,265,823	77.2	175,029,000	44.7	78,153,403			33	50	494,948	1,937,416
1886	2,287,136	73.5	168,051,000	46.7	78,441,940	44	47	65	90	434,864	1,432,490
1887	2,357,322	56.9	134,103,000	68.2	91,506,740	70	83	65	85	403,880	8,259,538
1888	2,533,280	79.9	202,365,000	40.2	81,413,589	30	37	24	45	471,955	883,380
1889	2,647,398	77.4	204,881,441	35.4	72,610,934	33	45	30	60	406,618	3,415,578
1890	2,651,579	55.9	148,289,696	75.8	112,341,705	82	93	95	110	341,189	5,401,912
1891	2,714,770	93.7	254,423,607	35.8	91,012,962	30	40	30	50	557,022	186,871
1892	2,547,962	61.5	156,654,819	66.1	103,567,520	60	72	70	98	845,720	4,317,021
1893	2,605,186	70.3	183,034,203	59.4	108,661,801	51	60	64	88	803,111	3,002,578
1894	2,737,973	62.4	170,787,338	53.6	91,526,787	43	58	40	70	572,957	1,341,533
1895	2,954,952	100.6	297,237,370	26.6	73,984,901	18	24	10	23	680,049	175,240
1896	2,767,465	91.1	252,234,540	28.6	72,182,350	18	26	19	26	926,646	246,178
1897	2,534,577	64.7	164,015,964	54.7	89,643,059	50	62	60	87	605,187	1,171,378
1898	2,557,729	75.2	192,306,338	41.4	79,574,772	30	36	33	52	579,833	530,420
1899	2,581,353	88.6	228,783,232	39.0	89,328,832	35	46	27	39	809,472	155,861
1900	2,611,054	80.8	210,926,897	43.1	90,811,167	40	48	35	60	741,483	371,911
1901	2,864,335	65.5	187,598,087	76.7	143,979,470	75	82	58	100	528,484	7,656,162
1902	2,965,587	96.0	284,632,787	47.1	134,111,436	42	45	42	60	843,075	358,505
1903	2,916,855	84.7	247,127,880	61.4	151,638,094	60	66	95	116	484,042	3,166,581
1904	3,015,675	110.4	332,830,300	45.3	150,673,392	32	38	20	25	1,163,270	181,199
1905	2,996,757	87.0	260,741,294	61.7	160,821,080	55	66	48	73	1,000,326	1,948,160
1906	3,013,150	102.2	308,038,382	51.1	157,547,392	40	43				

Condition of the potato crop of the United States, monthly, 1889–1906.

Year.	July.	Aug.	Sept.	Oct.	Year.	July.	Aug.	Sept.	Oct.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1889	95.1	94.3	81.7	77.9	1898	95.5	83.9	77.7	72.5
1890	91.7	77.4	65.7	61.7	1899	93.8	93.0	86.3	81.7
1891	95.3	96.5	94.8	91.3	1900	91.3	88.2	80.0	74.4
1892	90.0	86.8	74.8	67.7	1901	87.4	62.3	52.2	54.0
1893	94.8	86.0	71.8	71.2	1902	92.9	94.8	89.1	82.5
1894	92.3	74.0	62.4	64.3	1903	88.1	87.2	84.3	74.6
1895	91.5	89.7	90.8	87.4	1904	93.9	94.1	91.6	89.5
1896	99.0	94.8	83.2	81.7	1905	91.2	87.2	80.9	74.3
1897	87.8	77.9	66.7	61.6	1906	91.5	89.0	85.3	82.2

Acreage, production, and value of potatoes in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
Maine	109,516	210	22,998,360	50	11,499,180
New Hampshire	19,329	112	2,164,848	60	1,298,909
Vermont	26,300	101	2,656,300	55	1,460,965
Massachusetts	29,149	114	3,322,986	65	2,159,941
Rhode Island	6,360	108	686,880	80	549,504
Connecticut	31,931	98	3,129,238	72	2,253,051
New York	420,406	105	44,142,630	49	21,629,889
New Jersey	67,353	120	8,082,360	66	5,334,358
Pennsylvania	253,797	94	23,856,918	57	13,598,443
Delaware	7,600	97	737,200	59	434,948
Maryland	28,751	93	2,673,843	56	1,497,352
Virginia	55,656	75	4,174,200	67	2,796,714
West Virginia	34,376	97	3,334,472	61	2,034,028
North Carolina	23,812	75	1,785,900	74	1,321,566
South Carolina	9,065	82	743,330	105	780,496
Georgia	8,627	77	664,279	110	730,707
Florida	3,946	85	335,410	110	368,951
Ohio	157,072	110	17,277,920	48	8,293,402
Indiana	75,483	89	6,717,987	57	3,829,253
Illinois	150,638	97	14,611,886	62	9,059,369
Michigan	285,000	95	27,075,000	34	9,205,500
Wisconsin	245,000	97	23,765,000	30	7,129,500
Minnesota	131,782	92	12,123,944	37	4,485,850
Iowa	140,000	95	13,300,000	43	5,719,009
Missouri	85,228	84	7,159,152	57	4,080,717
North Dakota	25,171	98	2,466,758	46	1,134,709
South Dakota	35,422	100	3,542,200	35	1,239,770
Nebraska	84,530	87	7,354,110	52	3,824,137
Kansas	85,000	79	6,715,000	70	4,700,500
Kentucky	34,736	82	2,848,352	61	1,737,495
Tennessee	22,420	80	1,793,600	62	1,112,032
Alabama	9,258	75	694,350	93	645,746
Mississippi	5,628	85	478,380	87	416,191
Louisiana	12,000	62	744,000	75	558,000
Texas	31,097	77	2,394,469	87	2,083,188
Indian Territory	12,247	76	930,772	75	698,079
Oklahoma	10,498	85	892,330	80	713,864
Arkansas	20,837	80	1,666,960	67	1,116,863
Montana	14,099	152	2,143,048	61	1,307,259
Wyoming	4,202	115	483,230	65	314,100
Colorado	46,968	125	5,871,000	45	2,641,950
New Mexico	1,426	121	172,546	90	155,291
Utah	11,987	165	1,977,855	50	988,928
Nevada	2,974	175	520,450	70	364,315
Idaho	11,900	175	2,082,500	41	853,825
Washington	34,199	129	4,411,671	56	2,470,536
Oregon	40,083	101	4,048,383	56	2,267,094
California	50,291	125	6,286,375	74	4,651,918
United States	3,013,150	102.2	308,038,382	51.1	157,547,392

Average yield per acre of potatoes in the United States, 1897–1906, by States.

State or territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*
Maine	59	130	139	126	150	130	196	215	175	210
New Hampshire	51	90	127	101	108	120	98	135	120	112
Vermont	70	105	132	134	90	94	138	128	98	101
Massachusetts	62	97	134	79	77	109	96	119	97	114
Rhode Island	110	123	142	94	98	164	125	137	125	108
Connecticut	54	100	130	96	81	92	96	96	92	98
New York	62	73	88	81	78	66	89	93	70	105
New Jersey	58	75	83	69	59	132	99	115	93	120
Pennsylvania	63	54	85	58	62	83	91	106	90	94
Delaware	60	49	52	48	55	79	84	84	93	97
Maryland	74	58	64	55	60	80	70	99	95	93
Virginia	61	68	66	58	71	75	84	83	84	75
West Virginia	56	62	72	80	52	96	80	101	88	97
North Carolina	66	67	57	61	64	64	67	78	77	75
South Carolina	65	65	56	78	70	69	81	88	83	82
Georgia	52	54	46	68	64	58	73	70	65	77
Florida	75	64	69	60	62	90	82	102	75	85
Ohio	42	61	71	76	54	94	83	98	78	110
Indiana	31	71	76	83	31	101	76	93	80	89
Illinois	38	70	98	92	35	115	72	108	75	97
Michigan	72	79	66	97	81	72	78	121	67	95
Wisconsin	96	98	103	103	75	115	58	126	68	97
Minnesota	106	85	96	81	68	98	64	102	82	92
Iowa	60	80	100	72	32	98	56	136	80	95
Missouri	42	66	82	93	17	125	66	96	82	84
North Dakota	99	87	103	52	110	105	84	111	95	98
South Dakota	94	72	78	73	45	74	89	96	96	100
Nebraska	69	65	94	66	33	137	64	120	[illegible]	87
Kansas	48	70	95	72	26	135	58	80	81	79
Kentucky	47	64	51	70	35	80	73	83	85	82
Tennessee	40	52	44	54	46	62	66	71	80	80
Alabama	55	74	56	69	67	50	67	61	80	75
Mississippi	59	74	61	66	62	69	82	82	110	85
Louisiana	64	75	60	70	60	65	50	70	64	62
Texas	60	78	64	62	54	66	67	72	64	77
Indian Territory	......	......	......	......	63	85	70	69	76	76
Oklahoma	......	......	......	......	55	97	78	85	77	85
Arkansas	55	74	63	72	46	72	70	77	65	80
Montana	156	104	141	134	157	153	176	143	120	152
Wyoming	150	120	125	99	113	100	167	161	170	115
Colorado	97	77	84	56	120	100	145	159	160	125
New Mexico	90	58	49	19	50	72	87	62	75	121
Utah	148	135	120	118	114	157	177	137	132	165
Nevada	135	155	102	156	141	212	117	131	120	175
Idaho	140	120	124	136	108	149	160	139	140	175
Washington	162	108	144	116	117	136	145	120	142	129
Oregon	130	86	115	110	90	103	107	87	110	101
California	105	95	119	104	101	118	130	129	165	125
General average	64.7	75.2	88.6	80.8	65.5	96.0	84.7	110.4	87.0	102.2

Average value of potatoes in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904	1905.	1906.
Maine	$52.51	$59.80	$58.38	$61.74	$100.50	$84.50	$109.76	$103.20	$106.75	$105.00
New Hampshire	45.90	44.10	58.42	53.53	85.32	82.80	63.70	75.60	86.40	67.20
Vermont	49.00	44.10	47.52	53.60	57.60	54.52	69.00	60.16	69.58	55.55
Massachusetts	55.80	61.11	76.38	52.14	69.30	88.29	68.16	84.49	81.48	74.10
Rhode Island	108.70	78.72	71.00	65.80	91.14	123.00	102.50	104.12	111.25	86.40
Connecticut	48.60	55.00	59.80	67.20	76.14	67.16	74.88	69.12	83.72	70.56
New York	41.54	30.66	35.20	36.45	55.38	38.94	49.84	50.22	49.00	51.45
New Jersey	56.04	45.75	42.33	41.40	50.15	80.52	68.31	70.15	69.75	79.20
Pennsylvania	41.58	31.32	36.55	30.74	47.12	47.31	56.42	57.24	58.50	53.58
Delaware	39.00	33.81	26.52	28.80	42.90	40.29	47.04	44.52	54.87	57.23
Maryland	50.32	30.74	32.64	29.70	46.20	41.60	42.00	50.49	55.10	52.08
Virginia	42.70	37.40	36.96	34.22	52.54	43.50	53.76	45.65	47.04	50.25
West Virginia	36.40	33.48	37.44	40.80	44.20	48.96	52.80	54.54	51.04	59.17
North Carolina	42.24	41.54	37.62	39.65	46.08	42.88	49.58	54.60	52.36	55.50
South Carolina	68.25	65.00	58.24	78.00	77.00	66.24	84.24	88.88	85.49	86.10
Georgia	52.00	40.50	38.18	52.36	67.84	52.20	68.62	74.90	72.80	84.70
Florida	90.00	76.80	85.56	63.60	79.98	108.80	103.32	131.58	90.00	90.50
Ohio	29.04	25.01	30.53	30.40	45.90	41.36	50.63	46.06	49.14	52.80
Indiana	19.22	29.11	32.68	31.54	27.90	41.41	50.16	41.85	46.40	50.73
Illinois	23.56	32.20	39.36	37.72	32.55	49.56	51.84	50.76	50.25	60.14

Average value of potatoes in the United States, based upon farm value December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901	1902	1903	1904	1905.	1906.
Michigan	$30.96	$21.33	$21.12	$25.22	$55.08	$29.52	$38.22	$35.09	$37.52	$32.30
Wisconsin	37.62	23.52	26.78	28.84	50.25	37.95	33.64	35.28	42.16	29.10
Minnesota	32.86	21.25	24.00	24.30	45.56	30.38	39.04	29.58	41.00	34.04
Iowa	28.20	24.00	23.00	26.64	30.08	33.32	42.00	38.08	39.20	40.85
Missouri	26.46	29.04	33.20	32.55	18.02	44.80	50.16	46.08	45.10	47.88
North Dakota	32.67	29.58	27.81	25.48	53.90	34.65	40.32	35.52	36.10	45.08
South Dakota	30.08	20.16	21.06	26.28	38.25	32.56	48.06	28.80	36.48	35.00
Nebraska	31.74	24.05	23.50	32.34	34.65	36.99	41.60	31.20	34.41	45.24
Kansas	26.40	35.70	42.75	34.56	27.04	62.10	49.30	44.80	55.89	55.30
Kentucky	31.49	29.44	31.11	35.00	30.45	42.40	49.64	45.65	45.05	50.02
Tennessee	29.20	29.64	28.60	31.32	39.56	39.68	42.24	44.02	46.40	49.60
Alabama	51.70	61.42	48.72	56.58	73.03	46.50	64.32	60.39	70.40	69.75
Mississippi	48.38	53.28	62.22	54.78	71.30	63.48	72.16	69.70	93.50	73.95
Louisiana	54.40	58.50	48.60	55.30	60.60	53.30	45.50	63.70	58.24	46.50
Texas	57.00	67.08	58.24	54.56	67.50	56.10	58.96	66.96	59.52	66.99
Indian Territory					78.12	54.40	60.20	51.75	62.32	57.00
Oklahoma					69.30	74.69	76.44	65.45	67.76	68.00
Arkansas	46.20	40.70	44.73	41.04	57.96	48.96	55.30	57.75	47.45	53.60
Montana	62.40	57.20	74.73	71.02	114.61	76.50	77.44	87.23	70.80	92.72
Wyoming	82.50	78.00	76.25	67.32	112.40	65.27	95.19	99.82	95.20	74.75
Colorado	54.32	41.58	46.20	45.92	108.00	51.00	87.00	58.83	91.20	56.25
New Mexico	70.20	45.24	33.32	21.66	59.00	58.32	73.08	48.36	66.75	108.90
Utah	44.40	41.85	66.00	56.64	68.40	70.65	83.19	65.76	56.76	82.50
Nevada	98.55	139.50	91.80	87.36	128.31	133.56	81.90	85.15	98.40	122.50
Idaho	44.80	64.80	75.64	63.92	90.72	55.13	73.60	87.57	67.20	71.75
Washington	45.36	42.14	72.00	54.52	71.37	51.68	52.20	67.20	65.32	72.24
Oregon	64.00	40.42	56.35	49.50	63.00	56.65	53.50	51.33	66.00	56.56
California	51.45	52.25	74.97	55.12	77.77	68.44	85.80	86.43	110.55	92.50
General average	35.37	31.11	34.60	34.78	50.27	45.22	51.99	49.96	53.67	52.29

Average farm price of potatoes per bushel in the United States, December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$0.89	$0.46	$0.42	$0.49	$0.67	$0.65	$0.56	$0.48	$0.61	$0.50
New Hampshire	.90	.49	.46	.53	.79	.69	.65	.56	.72	.60
Vermont	.70	.42	.36	.40	.64	.58	.50	.47	.71	.55
Massachusetts	.90	.63	.57	.66	.90	.81	.71	.71	.84	.65
Rhode Island	.97	.64	.50	.70	.93	.75	.82	.76	.89	.80
Connecticut	.90	.55	.46	.70	.94	.73	.78	.72	.91	.72
New York	.67	.42	.40	.45	.71	.59	.56	.54	.70	.49
New Jersey	.78	.61	.51	.60	.85	.61	.69	.61	.75	.66
Pennsylvania	.66	.58	.43	.53	.76	.57	.62	.54	.65	.57
Delaware	.65	.69	.51	.60	.78	.51	.56	.53	.59	.59
Maryland	.68	.53	.51	.54	.77	.52	.60	.51	.58	.56
Virginia	.70	.55	.56	.59	.74	.58	.64	.55	.56	.67
West Virginia	.65	.54	.52	.51	.85	.51	.66	.54	.58	.61
North Carolina	.64	.62	.66	.65	.72	.67	.74	.70	.68	.74
South Carolina	1.05	1.00	1.04	1.00	1.10	.96	1.04	1.01	1.03	1.05
Georgia	1.00	.75	.83	.77	1.06	.90	.94	1.07	1.12	1.10
Florida	1.20	1.20	1.24	1.06	1.29	1.22	1.26	1.29	1.20	1.10
Ohio	.62	.41	.43	.40	.85	.44	.61	.47	.63	.48
Indiana	.62	.41	.43	.38	.90	.41	.66	.45	.58	.57
Illinois	.62	.46	.41	.41	.93	.42	.72	.47	.67	.62
Michigan	.43	.27	.32	.26	.68	.41	.49	.29	.56	.34
Wisconsin	.38	.24	.26	.28	.67	.33	.58	.28	.62	.30
Minnesota	.31	.25	.25	.30	.67	.31	.61	.29	.50	.37
Iowa	.47	.30	.23	.37	.94	.34	.75	.28	.49	.43
Missouri	.63	.44	.40	.35	1.06	.35	.76	.48	.55	.57
North Dakota	.33	.34	.27	.49	.49	.33	.48	.32	.38	.46
South Dakota	.32	.28	.27	.36	.85	.44	.54	.30	.38	.35
Nebraska	.46	.37	.25	.49	1.05	.27	.65	.26	.37	.52
Kansas	.55	.51	.45	.48	1.04	.45	.85	.56	.69	.70
Kentucky	.67	.46	.61	.50	.87	.53	.68	.55	.53	.61
Tennessee	.73	.57	.65	.58	.86	.64	.64	.62	.58	.62
Alabama	.94	.83	.87	.82	1.09	.93	.96	.99	.88	.93
Mississippi	.82	.72	1.02	.83	1.15	.92	.88	.85	.85	.87
Louisiana	.85	.75	.81	.79	1.01	.82	.91	.91	.91	.75
Texas	.95	.86	.91	.88	1.25	.85	.88	.93	.93	.87
Indian Territory					1.24	.64	.86	.75	.82	.75
Oklahoma					1.26	.77	.98	.77	.88	.80
Arkansas	.84	.55	.71	.57	1.26	.68	.79	.75	.73	.67
Montana	.40	.55	.53	.53	.73	.50	.44	.61	.59	.61

Average farm price of potatoes per bushel in the United States, December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Wyoming	$0.55	$0.65	$0.61	$0.68	$1.00	$0.61	$0.57	$0.62	$0.56	$0.65
Colorado	.56	.54	.55	.82	.90	.51	.60	.37	.57	.45
New Mexico	.78	.78	.68	1.14	1.18	.81	.84	.78	.89	.90
Utah	.30	.31	.55	.48	.60	.45	.47	.48	.43	.50
Nevada	.73	.90	.90	.56	.91	.63	.70	.65	.82	.70
Idaho	.32	.54	.61	.47	.84	.37	.46	.63	.48	.41
Washington	.28	.39	.50	.47	.61	.38	.56	.56	.46	.56
Oregon	.40	.47	.49	.45	.70	.55	.50	.59	.60	.56
California	.49	.55	.63	.53	.77	.58	.66	.67	.67	.74
General average	54.7	41.4	39.0	43.1	76.7	47.1	61.4	45.3	61.7	51.1

Wholesale prices of potatoes in leading cities of the United States, 1902–1906.

Date.	Cincinnati.		Chicago.		Milwaukee.		St. Louis.	
	Per barrel.		Burbank, per bushel.		Per bushel.		Burbank, per bushel.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.			*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	$2.20	$2.40	70	80	72	87	78	83
February	2.10	2.40	68	76	72	85	78	84
March	2.10	2.60	68	80	70	85	76	90
April	2.45	3.00	72	100	70	103	81	105
May	2.25	3.00	58	100	50	103	90	105
June	2.10	2.40	47	60	40	90	72	80
July	.90	2.40	....	....	30	85	....	....
August	.90	1.05	....	....	28	50	....	....
September	.95	1.35	30	38	28	40	....	....
October	1.25	1.35	30	44	30	40	41	44
November	1.50	1.60	42	48	34	43	50	54
December	1.35	1.50	42	48	35	43	51	55
1903.								
January	1.65	1.80	45	48	40	45	50	55
February	1.50	1.60	45	47	38	40	51	54
March	1.50	1.70	43	47	35	40	50	53
April	1.35	1.65	38	46	35	40	42	54
May	1.65	1.90	42	60	35	52	45	63
June	1.50	3.00	50	85	46	90	65	125
July	1.75	2.25	....	....	35	75	40	65
August	1.75	1.95	....	....	40	70	....	....
September	1.50	1.80	....	....	35	60	....	....
October	1.20	1.80	54	60	45	60	55	72
November	1.20	2.10	50	70	50	65	67	80
December	1.80	2.10	60	66	55	65	65	68
1904.								
January	1.95	2.55	62	95	50	85	69	73
February	2.70	2.85	85	91	78	85	90	96
March	2.80	4.50	86	102	83	95	94	97
April	3.75	4.80	89	122	90	120	115	125
May	3.50	4.80	95	116	75	118	105	115
June	2.70	4.50	115	118	75	120	....	....
July	2.00	3.00	....	....	40	90	....	....
August	1.50	1.80	....	....	30	60	....	....
September	1.35	1.65	....	....	28	78	47	52
October	1.20	1.50	31	40	25	33	42	45
November	1.20	1.50	32	42	20	30	36	43
December	1.20	1.35	32	38	20	30	36½	45
1905.	Per bushel.							
January	.38	.42	32	38	22	32	35	42
February	.35	.43	33	37	22	32	40	50
March	.25	.40	25	37	20	30	31	38
April	.25	.32	20	29	18	25	27	40
May	.25	.30	20	25	15	26	65	175
June	.25	.60	18	25	10	21	35	70
July	.45	.55	....	....	10	52	35	45
August	.45	.50	....	....	35	55	30	48
September	.45	.55	43	48	35	50	40	60
October	.50	.75	43	72	38	65	52	73
November	.60	.75	64	70	50	70	62	80
December	.55	.80	55	66	40	62	58	66

Wholesale prices of potatoes in leading cities of the United States, 1902–1906—Con.

Date.	Cincinnati.		Chicago.		Milwaukee.		St. Louis.	
	Per bushel.		Burbank, per bushel.		Per bushel.		Burbank, per bushel.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1906.			*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	$0.55	$0.65	55	66	45	58	58	82
February	.45	.62	47	57	35	50	53	61
March	.45	.75	43	68	35	62	51	70
April	.60	.85	57	63	50	62	65	68
May	.55	.75	48	73	45	75	60	88
June	.90	1.05	60	87	50	80	65	125
July	.75	.90			40	87	35	75
August	.58	.80			35	50	37	60
September	.55	.60	45	58	35	55	43	62
October	.50	.60	40	47	25	40	48	56
November	.45	.58	41	48	25	40	45	55
December	.45	.47	40	43	25	40	40	46

HAY.

Acreage, production, value, prices, and exports of hay of the United States, 1866–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per ton Dec. 1.	Farm value Dec. 1.	Chicago prices No. 1 timothy per ton, by carload lots.				Domestic exports, fiscal year beginning July 1.
						December.		May of following year.		
						Low.	High.	Low.	High.	
	Acres.	*Tons.*	*Tons.*	*Dolls.*	*Dollars.*	*Dolls.*	*Dolls.*	*Dolls.*	*Dolls.*	*Tons.*
1866	17,668,904	1.23	21,778,627	10.14	220,835,771					5,028
1867	20,020,554	1.31	26,277,000	10.21	268,300,623					5,645
1868	21,541,573	1.21	26,141,900	10.08	263,589,235					
1869	18,591,281	1.42	26,420,000	10.18	268,933,048					6,723
1870	19,861,805	1.23	24,525,000	12.47	305,743,224					4,581
1871	19,009,052	1.17	22,239,400	14.30	317,939,799					5,266
1872	20,318,936	1.17	23,812,800	12.94	308,024,517					4,557
1873	21,894,084	1.15	25,085,100	12.53	314,241,037					4,889
1874	21,769,772	1.15	25,133,900	11.94	300,222,454					7,183
1875	23,507,964	1.19	27,873,600	10.78	300,377,839					7,528
1876	25,282,797	1.22	30,867,100	8.97	276,991,422			9.00	10.00	7,287
1877	25,367,708	1.25	31,629,300	8.37	264,879,796	9.50	10.50	9.75	10.75	9,514
1878	26,931,300	1.47	39,608,296	7.20	285,015,625	8.00	8.50	9.00	11.50	8,127
1879	27,484,991	1.29	35,493,000	9.32	330,804,494	14.00	14.50	14.00	15.00	13,739
1880	25,863,955	1.23	31,925,233	11.65	371,811,084	15.00	15.50	17.00	19.00	12,662
1881	30,888,700	1.14	35,135,064	11.82	415,131,366	16.00	16.50	15.00	16.50	10,570
1882	32,339,585	1.18	38,138,049	9.70	371,170,326	11.50	12.25	12.00	13.00	13,309
1883	35,515,948	1.32	46,864,009	8.19	383,834,451	9.00	10.00	12.50	17.00	16,908
1884	38,571,593	1.26	48,470,460	8.17	396,139,309	10.00	11.50	15.50	17.50	11,142
1885	39,849,701	1.12	44,731,550	8.71	389,752,873	11.00	12.00	10.00	12.00	13,390
1886	36,501,688	1.15	41,796,499	8.46	353,437,699	9.50	10.50	11.00	12.50	13,873
1887	37,664,739	1.10	41,454,458	9.97	413,440,283	13.50	14.50	17.00	21.00	18,198
1888	38,591,903	1.21	46,643,094	8.76	408,499,565	11.00	11.50	10.50	11.00	21,928
1889	52,947,236	1.26	66,829,612	7.04	470,374,948	9.00	10.00	9.00	14.00	36,274
1890	50,712,513	1.19	60,197,589	7.87	473,569,972	9.00	10.50	12.50	15.50	28,066
1891	51,044,490	1.19	60,817,771	8.12	494,113,616	12.50	15.00	13.50	14.00	35,201
1892	50,853,061	1.18	59,823,735	8.20	490,427,798	11.00	11.50	12.00	13.50	33,084
1893	49,613,469	1.33	65,766,158	8.68	570,882,872	10.00	10.50	10.00	10.50	54,446
1894	48,321,272	1.14	54,874,408	8.54	468,578,321	10.00	11.00	10.00	10.25	47,117
1895	44,206,453	1.06	47,078,541	8.35	393,185,615	12.00	12.50	11.50	12.00	59,052
1896	43,259,756	1.37	59,282,158	6.55	388,145,614	8.00	8.50	8.50	9.00	61,658
1897	42,426,770	1.43	60,664,876	6.62	401,390,728	8.00	8.50	9.50	10.50	81,827
1898	42,780,827	1.55	66,376,920	6.00	398,060,647	8.00	8.25	9.50	10.50	64,916
1899	41,328,462	1.35	56,655,756	7.27	411,926,187	10.50	11.50	10.50	12.50	72,716
1900	39,132,890	1.28	50,110,906	8.89	445,538,870	11.50	14.00	12.50	13.50	89,364
1901	39,390,508	1.28	50,590,877	10.01	506,191,533	13.00	13.50	12.50	13.50	153,431
1902	39,825,227	1.50	59,857,576	9.06	542,036,364	12.00	12.50	13.50	15.00	50,970
1903	39,933,759	1.54	61,305,940	9.08	556,376,880	10.00	12.00	12.00	15.00	60,730
1904	39,998,602	1.52	60,696,028	8.72	529,107,625	10.50	11.50	11.00	12.00	66,557
1905	39,361,960	1.54	60,531,611	8.52	515,959,784	10.00	12.00	11.50	12.50	70,172
1906	42,476,224	1.35	57,145,959	10.37	592,539,671	15.50	18.00			

Acreage, production, and value of hay in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Tons.*	*Tons.*	*Dollars.*	*Dollars.*
Maine	1,329,835	1.20	1,595,802	10.25	16,356,970
New Hampshire	625,725	1.15	719,584	12.50	8,994,800
Vermont	870,530	1.20	1,044,636	10.00	10,446,360
Massachusetts	582,832	1.31	763,510	17.00	12,979,670
Rhode Island	61,980	1.06	65,699	17.40	1,143,163
Connecticut	489,599	1.17	572,831	15.00	8,592,465
New York	4,717,641	1.28	6,038,580	12.10	73,066,818
New Jersey	424,525	1.32	560,373	15.95	8,937,949
Pennsylvania	3,072,021	1.30	3,993,627	13.40	53,514,602
Delaware	74,038	1.25	92,548	15.00	1,388,222
Maryland	280,291	1.26	353,167	13.50	4,767,754
Virginia	427,253	1.25	534,066	15.50	8,278,023
West Virginia	517,384	1.40	724,338	14.00	10,140,732
North Carolina	125,633	1.54	193,475	15.00	2,902,125
South Carolina	60,682	1.46	88,596	15.25	1,351,089
Georgia	88,054	1.65	145,289	15.75	2,288,302
Florida	20,000	1.50	30,000	15.00	450,000
Ohio	2,850,000	1.22	3,477,000	12.00	41,724,000
Indiana	2,375,000	1.10	2,612,500	12.50	32,656,250
Illinois	2,638,035	.98	2,585,274	12.50	32,315,925
Michigan	2,650,000	1.28	3,392,000	10.35	35,107,200
Wisconsin	2,300,000	1.35	3,105,000	9.00	27,945,000
Minnesota	858,465	1.70	1,459,390	5.50	8,026,645
Iowa	3,500,000	1.35	4,725,000	7.00	33,075,000
Missouri	2,728,349	.78	2,128,112	10.00	21,281,120
North Dakota	177,368	1.45	257,184	4.50	1,157,328
South Dakota	221,422	1.50	332,133	4.50	1,494,598
Nebraska	1,350,000	1.40	1,890,000	5.60	10,584,000
Kansas	1,724,154	1.28	2,206,917	6.25	13,793,231
Kentucky	447,202	1.35	603,723	13.25	7,999,330
Tennessee	339,446	1.51	512,563	13.45	6,893,972
Alabama	56,350	1.95	109,882	13.30	1,461,431
Mississippi	43,873	1.90	83,359	11.45	954,461
Louisiana	21,488	1.93	41,472	11.50	476,928
Texas	379,836	1.80	683,705	8.50	5,811,492
Indian Territory	46,140	1.40	64,596	5.50	355,278
Oklahoma	298,969	1.40	418,557	5.75	2,406,703
Arkansas	70,932	1.60	113,491	9.9[illegible]	1,123,561
Montana	373,827	1.85	691,580	8.90	6,155,062
Wyoming	188,327	2.25	423,736	7.75	3,283,954
Colorado	638,617	2.50	1,596,542	9.50	15,167,149
New Mexico	76,714	2.50	191,785	10.75	2,061,689
Arizona	63,685	3.50	222,898	12.00	2,674,776
Utah	351,272	4.00	1,405,088	7.50	10,538,160
Nevada	170,175	1.50	255,262	8.00	2,042,096
Idaho	413,064	2.95	1,218,539	8.00	9,748,312
Washington	348,830	2.38	830,215	11.00	9,132,365
Oregon	393,977	2.18	858,870	7.85	6,742,130
California	612,684	1.85	1,133,465	11.25	12,751,481
United States	42,476,224	1.35	57,145,959	10.37	592,539,671

Average yield per acre of hay in the United States, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Maine	1.10	1.20	0.90	0.90	1.05	1.07	0.98	1.10	1.08	1.20
New Hampshire	1.15	1.25	.89	.87	1.28	1.06	.92	1.02	1.16	1.15
Vermont	1.30	1.45	1.14	1.24	1.36	1.27	1.18	1.25	1.35	1.20
Massachusetts	1.40	1.42	1.13	.97	1.21	1.60	1.36	1.23	1.33	1.31
Rhode Island	1.15	1.18	.89	.92	.92	1.03	1.07	1.16	1.09	1.06
Connecticut	1.20	1.31	.94	.89	1.01	1.35	1.11	1.06	1.12	1.17
New York	1.35	1.40	1.04	.81	1.30	1.34	1.26	1.36	1.30	1.28
New Jersey	1.75	1.42	.83	1.26	1.32	1.22	1.28	1.39	1.13	1.32
Pennsylvania	1.40	1.45	1.20	1.10	1.19	1.19	1.27	1.45	1.50	1.30
Delaware	1.35	1.38	1.04	.98	1.12	1.09	1.64	1.59	1.55	1.25
Maryland	1.35	1.20	1.13	1.09	1.22	1.01	1.24	1.36	1.30	1.26
Virginia	1.08	1.32	1.10	1.16	1.20	1.05	1.30	1.39	1.30	1.25
West Virginia	1.35	1.54	1.29	1.18	1.37	1.12	1.38	1.47	1.48	1.40
North Carolina	1.25	1.70	1.50	1.41	1.66	1.44	1.60	1.72	1.60	1.54
South Carolina	1.00	1.60	1.22	1.32	1.46	1.22	1.46	1.53	1.42	1.46
Georgia	1.35	1.75	1.45	1.69	1.46	1.36	1.53	1.52	1.50	1.65
Florida	1.00	1.60	1.46	1.20	1.48	1.24	1.47	1.36	1.48	1.50

Average yield per acre of hay in the United States, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Ohio	1.44	1.39	1.30	1.06	1.36	1.43	1.42	1.43	1.49	1.22
Indiana	1.43	1.45	1.34	1.21	1.27	1.46	1.47	1.37	1.48	1.10
Illinois	1.29	1.56	1.29	1.27	1.08	1.50	1.54	1.36	1.35	.98
Michigan	1.49	1.36	1.22	1.29	1.26	1.45	1.37	1.25	1.46	1.28
Wisconsin	1.35	1.50	1.47	1.15	1.29	1.90	1.89	1.67	1.80	1.35
Minnesota	1.57	1.80	1.70	1.16	1.55	1.76	1.84	1.74	1.75	1.70
Iowa	1.50	1.75	1.34	1.42	1.25	1.68	1.78	1.62	1.70	1.35
Missouri	1.15	1.60	1.37	1.29	.75	1.59	1.57	1.47	1.10	.78
North Dakota	1.60	1.50	1.58	.92	1.60	1.66	1.18	1.57	1.55	1.45
South Dakota	1.25	1.38	1.43	1.18	1.15	1.23	1.45	1.43	1.60	1.50
Nebraska	1.60	1.60	1.66	1.38	1.25	1.74	1.68	1.76	1.75	1.40
Kansas	1.30	1.46	1.57	1.32	.91	1.70	1.58	1.67	1.55	1.28
Kentucky	1.17	1.45	1.29	1.40	1.34	1.44	1.46	1.44	1.30	1.35
Tennessee	1.45	1.50	1.31	1.40	1.52	1.44	1.58	1.66	1.60	1.51
Alabama	1.45	1.90	1.66	1.85	1.75	1.50	1.77	1.71	1.90	1.95
Mississippi	1.48	1.90	1.44	1.75	1.69	1.40	1.74	1.72	1.75	1.90
Louisiana	1.90	2.10	1.95	2.00	1.85	1.80	2.04	2.06	2.30	1.93
Texas	1.40	1.50	1.43	1.80	1.25	1.40	1.84	1.77	1.90	1.80
Indian Territory	......	......	......	......	1.46	1.32	1.50	1.49	1.27	1.40
Oklahoma	......	......	......	......	.96	1.26	1.34	1.51	1.43	1.40
Arkansas	1.30	1.54	1.48	1.63	1.10	1.60	1.60	1.72	1.75	1.60
Montana	1.50	1.45	1.42	1.60	1.79	1.68	2.08	1.92	1.60	1.85
Wyoming	1.65	1.96	1.47	1.68	1.76	1.65	2.14	2.27	2.50	2.25
Colorado	2.25	2.20	2.10	2.23	2.08	1.92	2.56	1.85	2.65	2.50
New Mexico	3.50	3.75	1.70	2.06	2.31	2.40	2.36	2.58	2.70	2.50
Arizona	3.00	3.50	2.63	2.31	2.85	2.34	3.46	2.71	3.75	3.50
Utah	2.95	3.25	2.50	2.65	2.45	2.62	2.95	3.54	3.25	4.00
Nevada	2.50	2.60	1.87	2.43	2.50	2.91	3.12	3.04	2.50	1.50
Idaho	2.30	3.75	2.50	2.80	2.58	2.67	2.82	3.07	3.10	2.95
Washington	2.25	1.75	2.02	2.16	2.30	2.29	2.41	2.18	2.65	2.38
Oregon	1.90	1.90	1.97	2.35	2.07	2.04	2.07	2.04	2.30	2.18
California	1.60	1.60	1.63	1.51	1.82	1.81	2.08	2.03	2.40	1.85
General average	1.43	1.55	1.35	1.28	1.28	1.50	1.54	1.52	1.54	1.35

Average value per acre of hay in the United States, based upon farm value December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$10.73	$9.12	$9.09	$11.66	$10.96	$10.74	$10.00	$10.69	$10.69	$12.30
New Hampshire	13.23	11.56	10.46	13.48	15.87	14.36	12.20	13.76	15.08	14.38
Vermont	12.03	9.21	10.55	13.70	13.36	12.26	12.84	11.85	12.73	12.00
Massachusetts	19.46	17.18	17.52	16.88	21.16	26.64	22.74	19.38	20.24	22.27
Rhode Island	16.67	14.93	15.35	17.20	17.54	19.46	20.28	20.16	17.73	18.44
Connecticut	15.60	14.61	13.63	14.89	14.77	21.19	16.86	15.78	16.35	17.55
New York	11.14	8.05	10.87	11.38	13.75	14.11	13.81	14.20	13.49	15.49
New Jersey	18.81	13.63	12.74	20.22	18.86	19.08	19.70	20.39	16.74	21.05
Pennsylvania	12.81	11.46	13.80	15.29	15.90	16.66	17.15	17.14	17.90	17.42
Delaware	13.50	11.66	12.12	13.67	13.84	15.73	24.32	22.09	21.19	18.75
Maryland	14.17	11.16	13.73	15.31	16.07	14.19	17.38	16.97	15.50	17.01
Virginia	11.07	11.22	11.27	15.43	14.41	14.39	17.85	17.44	16.41	19.37
West Virginia	11.95	12.94	12.19	15.81	18.91	16.05	19.04	18.24	17.24	19.60
North Carolina	12.19	15.81	15.15	15.79	17.93	17.64	21.47	25.04	20.48	23.10
South Carolina	11.50	15.20	12.56	15.18	16.03	13.72	17.11	18.64	18.97	22.27
Georgia	17.55	20.56	19.07	21.55	20.92	18.22	23.18	23.01	23.63	25.99
Florida	14.25	22.56	22.41	16.44	22.72	19.02	27.67	22.67	24.05	22.50
Ohio	9.00	7.99	11.63	11.71	11.86	14.59	14.20	13.23	11.92	14.64
Indiana	8.44	8.12	10.45	11.80	11.79	12.66	12.58	11.75	11.16	13.75
Illinois	7.93	9.20	10.00	10.67	12.10	13.31	12.83	11.78	11.16	12.25
Michigan	11.55	9.72	10.37	12.19	10.85	12.03	12.23	11.36	11.24	13.25
Wisconsin	8.44	8.62	10.07	11.10	13.58	15.03	14.17	13.18	13.05	12.15
Minnesota	7.06	6.66	7.40	8.06	8.65	9.43	12.16	9.59	10.15	9.35
Iowa	6.37	7.09	7.10	9.66	9.59	10.92	9.72	8.68	8.67	9.45
Missouri	7.07	9.28	8.56	8.97	8.99	10.96	10.49	9.73	8.62	7.80
North Dakota	5.20	4.87	5.21	5.20	5.84	6.09	5.48	6.61	6.71	6.52
South Dakota	3.69	4.14	4.43	4.66	5.16	5.10	6.71	6.06	6.43	6.75
Nebraska	4.80	5.28	6.14	7.11	7.71	7.59	7.53	6.72	7.24	7.84
Kansas	4.42	4.74	5.49	6.01	7.25	7.33	7.60	7.31	7.87	8.00
Kentucky	11.70	13.19	13.42	15.89	16.25	16.27	17.62	16.57	13.82	17.89
Tennessee	15.59	14.25	14.74	16.52	18.71	16.99	19.42	19.94	18.43	20.31
Alabama	13.86	17.57	18.92	19.52	21.12	17.42	21.93	20.74	23.79	25.93
Mississippi	14.06	15.96	13.32	17.41	17.62	14.35	20.18	18.66	19.55	21.76
Louisiana	16.62	19.74	18.92	18.80	20.50	21.10	23.15	25.13	26.45	22.20
Texas	10.15	8.77	10.15	12.24	13.27	12.04	15.09	14.37	15.43	15.30
Indian Territory	......	......	......	......	11.01	6.57	8.86	6.88	6.79	7.70

Average value per acre of hay in the United States, based upon farm value December 1, 1897–1906, by States—Continued.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Oklahoma	......	......	......	......	$6.59	$6.68	$7.52	$7.40	$7.03	$8.05
Arkansas	$11.25	$10.39	$12.80	$11.43	12.89	15.04	15.17	16.89	16.80	15.84
Montana	11.63	9.86	10.93	13.92	14.60	12.67	18.32	16.70	12.32	16.46
Wyoming	9.90	11.40	9.70	12.26	12.64	12.01	14.27	13.05	15.52	17.44
Colorado	12.38	11.88	15.43	16.95	18.80	18.99	19.15	12.41	21.73	23.75
New Mexico	24.50	27.56	18.02	20.39	23.89	26.83	26.24	29.46	29.03	26.88
Arizona	15.00	42.00	27.22	26.10	26.16	28.62	35.78	40.22	46.39	42.00
Utah	14.01	14.62	17.75	21.07	20.70	19.18	20.18	22.34	21.68	30.00
Nevada	12.50	18.20	14.31	18.71	19.80	29.73	31.11	23.10	21.25	12.00
Idaho	12.08	18.37	15.75	18.20	15.25	14.69	19.64	18.67	18.29	23.60
Washington	20.25	13.30	17.98	20.52	19.60	20.45	30.78	24.72	25.63	26.18
Oregon	14.73	13.78	13.49	15.98	14.82	15.26	21.07	20.77	17.80	17.11
California	14.40	22.80	13.04	12.31	14.41	17.03	24.25	21.13	24.12	20.81
General average	9.46	9.30	9.97	11.39	12.85	13.61	13.93	13.23	13.11	13.95

Average farm price of hay per ton in the United States December 1, 1897–1906, by States.

State or Territory.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Maine	$9.75	$7.60	$10.10	$12.95	$10.44	$10.04	$10.20	$9.72	$9.90	$10.25
New Hampshire	11.50	9.25	11.75	15.50	12.40	13.55	13.26	13.49	13.00	12.50
Vermont	9.25	6.35	9.25	11.05	9.82	9.65	10.88	9.48	9.43	10.00
Massachusetts	13.90	12.10	15.50	17.40	17.49	16.65	16.72	15.76	15.22	17.00
Rhode Island	14.50	12.65	17.25	18.70	19.06	18.89	18.95	17.38	16.27	17.40
Connecticut	13.00	11.15	14.50	16.73	14.62	15.70	15.19	14.89	14.60	15.00
New York	8.25	5.75	10.45	14.05	10.58	10.53	10.96	10.44	10.38	12.10
New Jersey	10.75	9.60	15.35	16.05	14.29	15.64	15.39	14.67	14.81	15.95
Pennsylvania	9.15	7.90	11.50	13.90	13.64	14.00	13.50	11.82	11.93	13.40
Delaware	10.00	8.45	11.65	13.95	12.36	14.43	14.83	13.89	13.67	15.00
Maryland	10.50	9.30	12.15	14.05	13.17	14.05	14.02	12.48	11.92	13.50
Virginia	10.25	8.50	10.25	13.30	12.01	13.58	13.73	12.55	12.62	15.50
West Virginia	8.85	8.40	9.45	13.40	13.80	14.33	13.80	12.41	11.65	14.00
North Carolina	9.75	9.30	10.10	11.20	10.80	12.25	13.42	14.56	12.80	15.00
South Carolina	11.50	9.50	10.30	11.50	10.98	11.25	11.72	12.18	13.36	15.25
Georgia	13.00	11.75	13.15	12.75	14.33	13.40	15.15	15.14	15.75	15.75
Florida	14.25	14.10	15.35	13.70	15.35	15.34	18.82	16.67	16.25	15.00
Ohio	6.25	5.75	8.95	11.05	8.72	10.20	10.00	9.25	8.00	12.00
Indiana	5.90	5.60	7.80	9.75	9.28	8.67	8.56	8.58	7.54	12.50
Illinois	6.15	5.90	7.75	8.40	11.20	8.87	8.33	8.66	8.27	12.50
Michigan	7.75	7.15	8.50	9.45	8.61	8.30	8.93	9.09	7.70	10.35
Wisconsin	6.25	5.75	6.85	9.65	10.53	7.91	7.50	7.89	7.25	9.00
Minnesota	4.50	3.70	4.35	6.95	5.58	5.36	6.61	5.51	5.80	5.50
Iowa	4.25	4.05	5.30	6.80	7.67	6.50	5.46	5.36	5.10	7.00
Missouri	6.15	5.80	6.25	6.95	11.99	6.89	6.68	6.62	7.84	10.00
North Dakota	3.25	3.25	3.30	5.65	3.65	3.67	4.64	4.21	4.33	4.50
South Dakota	2.95	3.00	3.10	3.95	4.49	4.15	4.63	4.24	4.02	4.50
Nebraska	3.00	3.30	3.70	5.15	6.17	4.36	4.48	3.82	4.14	5.00
Kansas	3.40	3.25	3.50	4.55	7.97	4.31	4.81	4.38	5.08	6.25
Kentucky	10.00	9.10	10.40	11.35	12.13	11.30	12.07	11.51	10.63	13.25
Tennessee	10.75	9.50	11.25	11.80	12.31	11.80	12.29	12.01	11.52	13.45
Alabama	10.25	9.25	11.40	10.55	12.07	11.61	12.39	12.13	12.52	13.30
Mississippi	9.50	8.40	9.25	9.95	10.51	10.25	11.60	10.85	11.17	11.45
Louisiana	8.75	9.40	9.70	9.40	11.08	11.72	11.35	12.20	11.50	11.50
Texas	7.25	5.85	7.10	6.80	10.62	8.60	8.20	8.12	8.12	8.50
Indian Territory	......	......	......	......	7.54	4.98	5.91	4.62	5.35	5.50
Oklahoma	......	......	......	......	6.86	5.30	5.61	4.90	4.91	5.75
Arkansas	8.65	6.75	8.65	8.85	11.72	9.40	9.48	9.82	9.60	9.90
Montana	7.75	6.80	7.70	8.70	8.18	7.54	8.81	8.70	7.70	8.90
Wyoming	6.00	5.90	6.60	7.30	7.18	7.28	6.67	5.75	6.21	7.75
Colorado	5.50	5.40	7.35	7.60	9.04	9.89	7.48	6.71	8.20	9.50
New Mexico	7.00	7.35	10.60	9.90	10.34	11.18	11.12	11.42	10.75	10.75
Arizona	5.00	12.00	10.35	11.30	9.18	12.23	10.34	14.84	12.37	12.00
Utah	4.75	4.50	7.10	7.95	8.45	7.32	6.84	6.31	6.67	7.50
Nevada	5.00	7.00	7.65	7.70	7.92	9.05	9.97	7.60	8.50	8.00
Idaho	5.25	4.90	6.30	6.50	5.91	5.50	6.86	6.08	5.90	8.00
Washington	9.00	7.60	8.90	9.50	8.52	8.93	12.77	11.34	9.67	11.00
Oregon	7.75	7.25	6.85	6.80	7.16	7.48	10.18	10.18	7.74	7.85
California	9.00	14.25	8.00	8.15	7.92	9.41	11.66	10.41	10.05	11.25
General average	6.62	6.00	7.27	8.89	10.01	9.06	9.08	8.72	8.52	10.37

Wholesale prices of hay (baled) per ton in leading cities of the United States, 1902–1906.

Date.	Chicago.		Cincinnati.		St. Louis.		New York.	
	No. 1 timothy.		No. 1 timothy.		No. 1 timothy.		No. 1 timothy.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902								
January	$12.50	$13.00	$12.50	$13.75	$13.50	$15.50	$17.00	$18.00
February	12.00	12.50	12.50	13.25	13.00	14.50	17.00	19.00
March	12.00	12.50	12.75	13.25	13.00	14.50	17.00	19.00
April	12.50	13.00	12.75	13.25	13.00	15.25	17.00	19.00
May	12.50	13.50	13.00	13.50	13.00	15.50	17.00	19.00
June	12.00	12.50	12.75	13.00	12.00	15.00	18.00	19.00
July	12.00	12.50	13.75	15.50	13.00	16.00	18.00	21.00
August	12.00	12.50	12.00	15.50	10.00	15.00	18.00	22.00
September	12.00	12.50	11.00	13.00	9.50	12.00	17.00	18.50
October	12.00	12.50	13.00	14.00	11.00	13.00	17.50	20.00
November	12.00	12.50	13.00	14.00	11.00	13.50	18.00	20.00
December	12.00	12.50	13.75	16.50	13.50	15.50	18.00	20.00
1903.								
January	12.00	13.00	15.50	17.25	13.50	15.50	18.00	21.00
February	12.00	13.00	16.00	16.75	13.50	15.00	18.50	21.00
March	12.00	13.50	16.00	17.50	14.00	16.00	18.00	20.00
April	13.00	15.00	16.25	18.00	13.50	16.00	18.50	23.00
May	13.50	15.00	15.25	18.00	13.00	16.00	19.00	23.00
June	13.00	15.00	17.50	19.50	14.50	25.00	20.00	26.00
July	13.00	13.50	16.50	18.00	9.50	16.50	20.00	23.00
August	11.00	13.50	11.50	17.00	10.00	15.00	18.00	20.00
September	10.00	12.00	11.50	13.50	10.00	12.00	16.00	18.50
October	10.00	11.50	12.50	13.25	10.00	12.50	16.00	18.00
November	10.00	11.50	12.25	12.75	10.00	12.50	17.00	18.00
December	10.00	12.00	12.50	13.00	10.00	13.50	16.00	18.00
1904.								
January	10.50	12.50	12.50	13.25	10.00	11.50	16.00	18.00
February	10.50	12.50	12.50	13.50	10.50	11.50	16.50	19.00
March	10.50	13.00	12.50	14.00	10.50	12.00	17.00	19.00
April	11.50	14.50	13.75	14.00	11.00	13.00	18.00	19.00
May	12.00	15.00	14.00	15.50	12.50	13.00	18.00	19.00
June	12.00	15.00	13.00	14.00	12.00	13.50	17.00	19.00
July	10.00	14.00	12.00	13.75	12.00	13.00	17.00	18.00
August	10.00	15.00	11.50	14.00	11.50	13.50	17.00	18.00
September	9.00	12.00	11.00	12.25	10.50	12.50	15.00	18.00
October	10.00	12.50	11.50	12.50	10.50	12.50	15.00	16.00
November	10.00	12.50	11.25	12.00	11.00	11.50	15.50	17.00
December	10.50	11.50	12.00	12.50	10.50	11.50	15.00	16.00
1905.								
January	10.50	12.00	12.00	12.75	11.00	12.75	15.50	17.00
February	11.00	12.00	11.75	12.25	10.50	12.50	15.50	16.00
March	11.00	12.00	11.75	13.00	10.50	12.50	15.00	17.50
April	11.00	12.00	12.00	12.50	11.00	13.00	15.00	16.00
May	11.00	12.00	11.50	12.50	10.50	13.00	15.00	16.00
June	10.00	12.00	10.25	11.75	10.50	12.50	15.00	16.00
July	10.00	12.00	10.50	12.50	10.00	14.00	14.00	15.00
August	11.00	12.50	10.00	12.50	9.00	13.50	15.00	19.00
September	10.00	12.50	11.50	12.50	10.00	13.00	14.50	16.00
October	10.00	11.50	12.25	12.50	10.50	13.50	15.00	16.00
November	11.00	12.00	12.00	13.50	12.00	15.00	15.00	16.50
December	10.00	12.00	12.25	13.50	12.50	15.50	14.00	15.00
1906.								
January	10.00	11.00	12.00	13.00	12.00	14.00	16.00	17.00
February	9.50	10.50	11.00	12.50	11.50	14.00	15.00	16.50
March	9.80	12.00	12.50	13.50	12.00	15.00	15.50	16.00
April	10.00	12.50	13.50	14.75	13.50	17.00	15.50	19.00
May	11.50	12.50	14.50	16.25	14.50	18.00	17.50	19.50
June	11.50	13.00	15.00	16.00	14.00	17.00	18.00	19.00
July	12.00	16.00	15.50	18.00	11.00	17.50	18.00	20.00
August	13.00	16.00	15.25	16.00	12.00	16.50	18.00	20.00
September	13.50	16.00	15.00	16.25	13.50	15.50	17.50	19.00
October	13.50	15.50	16.00	18.25	14.50	16.50	17.50	21.00
November	15.00	17.00	17.75	19.00	15.00	18.50	19.00	23.00
December	15.50	18.00	19.00	19.50	17.50	20.00	20.00	22.00

COTTON.

Cotton crop of countries named, 1901–1905.

[No statistics for Siam and some other less important cotton-growing countries. Bales of 500 pounds, gross weight, or 478 pounds of lint, net.]

Country.	1901.	1902.	1903.	1904.	1905.
NORTH AMERICA.					
United States:	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Contiguous [a]	9,509,745	10,630,945	9,851,129	13,438,012	10,575,017
Noncontiguous — Porto Rico [b]	3		265	1,076	1,881
Total United States except Philippine Islands	9,509,748	10,630,945	9,851,394	13,439,088	10,576,898
Guatemala	e147	e147	147	e147	e147
Mexico	105,147	103,910	168,998	233,271	d290,000
Nicaragua [b]	e507	e507	e507	507	800
Salvador	e2	e2	e2	e2	2
West Indies:					
British—					
Bahamas [b]	2	3	13	18	14
Barbados			11	402	720
Grenada [b]	527	518	630	658	445
Jamaica [b]			6	30	184
Leeward Islands [b]			133	243	822
St. Lucia [b]				5	3
St. Vincent [b]	53	113	91	264	288
Trinidad and Tobago				33	b31
Turks and Caicos Islands [b]	5		1		
Cuba			77	g1	g1
French—					
Guadeloupe [b]	5	g	1	8	e1
Martinique [b]				12	e12
Haiti [b]	e h4,200	4,200	6,821	6,312	6,878
Total North America	9,618,343	10,740,345	10,028,832	13,701,054	10,877,306
SOUTH AMERICA.					
Argentina [b]		17	29	142	495
Brazil	210,000	305,000	287,000	220,000	270,000
British Guiana [b]			7	4	2
Chile [b]	948	900	887	634	815
Colombia and Venezuela [i]	5,000	5,000	5,000	5,000	5,000
Ecuador [b]	32	28		22	47
Peru	44,200	38,200	43,776	45,672	d65,000
Paraguay [i]	200	200	200	200	300
Total South America	260,480	349,345	334,889	271,674	341,559
EUROPE.					
Bulgaria	i765	i765	i765	i765	765
Crete [i]	700	700	700	700	700
Greece	8,200	8,200	8,200	8,200	8,200
Italy [i]	2,700	2,700	2,700	2,700	2,700
Malta	236	232	285	345	340
Turkey [d]	9,800	8,000	7,000	6,000	7,000
Total Europe	22,401	20,597	19,650	18,710	19,705
ASIA.					
British India, including native States [f]	2,770,819	3,138,920	2,965,875	3,028,000	3,548,000
Ceylon [b]	485	428	317	371	724
China [i]	1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Cyprus	1,028	817	692	1,128	1,637

a "Linters," a by-product obtained in the oil mills, not included. Quantity of linters produced as follows: Running bales, 166,026 in 1901, 196,223 in 1902; 500-pound bales, 194,486 in 1903, 241,942 in 1904, and 229,539 in 1905.

b Exports.

c Official estimate for 1903.

d Unofficial estimate.

e Exports, 1904.

f Exports, 1905.

g Less than one-half bale.

h Exports, 1902.

i Average production as unofficially estimated.

j Official estimate for 1905.

k Exports and mill consumption.

Cotton crop of countries named, 1901–1905—Continued.

Country.	1901.	1902.	1903.	1904.	1905.
ASIA—continued.	*Bales.*	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Dutch East Indies [a]	9,160	8,267	12,632	15,367	13,280
Federated Malay States			3	1	[b] 1
French India [a]				14	[c] 14
French Indo-China [a]	7,815	11,139	13,693	15,255	[c] 15,255
Japan	25,762	19,152	17,012	16,262	12,370
Korea [d]	70,000	70,000	70,000	70,000	70,000
Persia [a]	[e] 64,000	[e] 64,000	56,282	71,509	[b] 72,000
Philippine Islands	[f] 6,098	6,098	[f] 6,098	[f] 6,098	[f] 6,098
Russia, Asiatic:					
Central Asia	426,000	370,000	476,000	506,000	567,000
Transcaucasia [b]	56,000	56,000	53,000	49,000	45,000
Total Asiatic Russia	482,000	426,000	529,000	555,000	612,000
Turkey, Asiatic [d]	60,000	60,000	60,000	60,000	60,000
Total Asia	4,697,767	5,004,811	4,961,604	5,038,995	5,608,979
AFRICA.					
British Africa:					
Central Africa [a]		1	119	449	1,658
East Africa				609	208
Gambia [a]	(g)	(g)	3	125	5
Gold Coast [a]	6		22	121	61
Natal				3	[b] 31
Nigeria—					
Southern, Colony (including Lagos) [a]	16	26	606	1,805	2,680
Southern, Protectorate [a]				598	201
Northern, Protectorate [a]				601	258
Sierra Leone [a]			2	59	144
Uganda [a]				45	201
Total British Africa	22	27	752	4,415	5,447
Egypt	1,320,307	1,209,746	1,348,759	1,316,212	1,250,173
French Africa: [a]					
Dahomey				289	[c] 289
Madagascar			(g)	8	[c] 8
Mayotte			1		
Senegal			2	8	[c] 8
Somali Coast		(g)		41	[c] 41
Total French Africa			3	346	[c] 346
German Africa: [a]					
East Africa	1	2	43	872	871
Togo			148	499	618
Total German Africa	1	2	191	1,371	1,489
Kongo Free State [a]					1
Portuguese Africa—Angola [h]	100	61	6	[i] 6	[i] 6
Sudan (Anglo-Egyptian)	[i] 6,517	[i] 6,517	6,517	15,097	19,441
Total Africa	1,326,947	1,216,353	1,356,228	1,337,447	1,276,903
OCEANIA.					
British—Queensland		1	1	18	79
French: [a]					
New Caledonia				1	[b] 1
Tahiti	110	79	71	48	[b] 48
German—Bismarck Archipelago [a]		13	240	56	[b] 56
Total Oceania	110	93	312	123	184
Grand total	15,926,048	17,331,503	16,701,465	20,368,003	18,124,636

[a] Exports.
[b] Unofficial estimate.
[c] Exports, 1904.
[d] Average production as unofficially estimated.
[e] Average exports, 1903–1904.
[f] Census, 1902.
[g] Less than one-half bale.
[h] Imports from Angola into Portugal.
[i] Statistics for 1903.

International trade in cotton, 1901–1906.[a]

[Bales of 500 pounds, gross weight, or 478 pounds of lint, net.]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Brazil	Jan. 1	54,262	148,225	150,229	61,170	[b] 111,069
British India	Apr. 1	1,347,878	1,429,058	1,865,791	1,334,111	1,741,096
Egypt	Jan. 1	1,268,856	1,378,413	1,158,029	1,225,259	1,352,517
France	Jan. 1	127,715	117,738	152,127	150,462	164,814
Germany [c]	Jan. 1	216,810	257,289	283,743	319,732	293,838
Netherlands	Jan. 1	100,719	82,550	110,568	104,182	98,851
Peru	Jan. 1	36,948	30,826	35,289	34,741	53,040
United States	July 1	7,382,792	7,466,824	6,454,134	9,078,080	7,602,605
Other countries		168,300	304,900	391,000	581,300	252,900
Total		10,704,280	11,215,803	10,593,910	12,889,237	11,680,730

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Bales.	*Bales.*	*Bales.*	*Bales.*	*Bales.*
Austria-Hungary	Jan. 1	617,908	664,313	688,041	700,052	752,110
Belgium	Jan. 1	152,334	204,087	246,879	186,228	220,252
Canada	July 1	134,364	142,138	101,800	118,583	142,262
France	Jan. 1	980,936	985,018	1,167,740	957,710	1,104,096
Germany [c]	Jan. 1	1,723,038	1,895,505	1,992,090	2,082,693	2,112,481
Italy	Jan. 1	623,205	679,641	711,035	713,733	[b] 761,328
Japan	Jan. 1	697,024	946,919	816,657	753,849	1,184,213
Mexico	July 1	29,028	77,590	64,680	[b] 85,198	[b] 31,525
Netherlands	Jan. 1	193,382	182,427	199,729	205,091	210,026
Russia	Jan. 1	783,865	820,955	1,051,822	908,232	[b] 994,386
Spain	Jan. 1	360,966	392,993	368,653	325,157	[b] 365,907
Sweden	Jan. 1	76,496	83,166	83,194	80,325	89,154
United Kingdom	Jan. 1	3,395,697	3,225,052	3,113,890	3,559,028	4,017,610
United States	July 1	206,518	155,641	102,177	125,587	148,459
Other countries		433,500	441,200	389,700	459,100	325,200
Total		10,408,862	10,809,495	11,108,087	11,250,576	12,459,609

[a] See "General note," p. 546.
[b] Preliminary figures.
[c] Not including the free ports.

Condition of the cotton crop of the United States, monthly, 1889–1906.

Year.	June.	July.	August.	September.	October.	Year.	June.	July.	August.	September.	October.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*		*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1889	86.4	87.6	89.3	86.6	81.5	1898	89.0	91.2	91.2	79.8	75.4
1890	88.8	91.4	89.5	85.5	80.0	1899	85.7	87.8	84.0	68.5	62.4
1891	85.7	88.6	88.9	82.7	75.7	1900	82.5	75.8	76.0	68.2	67.0
1892	85.9	86.9	82.3	76.8	73.3	1901	81.5	81.1	77.2	71.4	61.4
1893	85.6	82.7	80.4	73.4	70.7	1902	95.1	84.7	81.9	64.0	58.3
1894	88.3	89.6	91.8	85.9	82.7	1903	74.1	77.1	79.7	81.2	65.1
1895	81.0	82.3	77.9	70.8	65.1	1904	83.0	88.0	91.6	84.1	75.8
1896	97.2	92.5	80.1	64.2	60.7	1905	77.2	77.0	74.9	72.1	71.2
1897	83.5	86.0	86.9	78.3	70.0	1906	84.6	83.3	82.9	77.3	71.6

Acreage, production, value, prices, and exports of cotton of the United States, 1899–1906.

Year.	Acreage.	Production.		Value.[a]	New York closing prices per pound on middling upland.				Domestic exports, fiscal year beginning July 1.
		Thousands of pounds. [(a)]	Bales of 500 pounds gross weight.[a]		December.		May of following year.		
					Low.	High.	Low.	High.	
	Acres.	*Pounds.*	*Bales.*	*Dollars.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Bales of 500 lbs.*
1899–1900	[b]24,275,101	4,467,097	9,345,391	370,708,746	$7\frac{1}{2}$	$7\frac{3}{4}$	9	$9\frac{7}{8}$	6,201,166
1900–1901	25,758,139	4,846,471	10,123,027	....	$9\frac{3}{4}$	$10\frac{5}{16}$	$8\frac{1}{16}$	$8\frac{5}{16}$	6,661,781
1901–1902	27,220,414	4,550,950	9,509,745	....	8	$8\frac{3}{4}$	$9\frac{3}{8}$	$9\frac{3}{4}$	7,001,558
1902–1903	27,114,103	5,091,641	10,630,945	421,687,941	$8\frac{1}{2}$	$8\frac{7}{8}$	10.75	12.15	7,086,086
1903–1904	28,016,893	4,716,591	9,851,129	576,499,824	11.95	14.10	12.75	13.90	6,126,386
1904–1905	30,053,739	6,426,698	13,438,012	561,100,386	6.85	9.00	7.85	8.85	8,609,698
1905–1906	26,117,153	5,060,205	10,575,017	556,833,818	11.65	12.60	11.25	12.00	7,268,090
1906–1907	[c]32,049,000	6,354,108	13,273,809	640,311,538	10.45	11.25	......	......	....

[a] As reported by U. S. Census Bureau.
[b] According to Report of Twelfth Census; the acreages for subsequent years are as estimated by the Bureau of Statistics, Department of Agriculture.
[c] As revised in June, 1907.

Prices of middling upland cotton in New Orleans, monthly, 1890–1906.

[In cents per pound.]

Year.	January.		February.		March.		April.		May.		June.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1890	$9\frac{5}{8}$	$10\frac{11}{16}$	$10\frac{3}{8}$	$10\frac{11}{16}$	$10\frac{11}{16}$	11	11	$11\frac{11}{16}$	$11\frac{9}{16}$	$11\frac{7}{8}$	$11\frac{7}{16}$	$11\frac{7}{8}$
1891	$8\frac{15}{16}$	$9\frac{5}{16}$	$8\frac{3}{4}$	$9\frac{1}{16}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{5}{16}$	$8\frac{11}{16}$	$8\frac{5}{16}$	$8\frac{3}{8}$	$7\frac{7}{8}$	$8\frac{1}{4}$
1892	$6\frac{13}{16}$	$7\frac{3}{16}$	$6\frac{1}{2}$	$6\frac{7}{8}$	$6\frac{1}{4}$	$6\frac{1}{2}$	$6\frac{3}{8}$	7	7	$7\frac{3}{16}$	$7\frac{1}{16}$	$7\frac{1}{2}$
1893	$9\frac{1}{4}$	$9\frac{5}{8}$	$8\frac{13}{16}$	$9\frac{1}{4}$	$8\frac{5}{16}$	9	$7\frac{7}{16}$	$8\frac{3}{16}$	$7\frac{1}{4}$	$7\frac{5}{8}$	$7\frac{5}{16}$	$7\frac{7}{8}$
1894	$7\frac{5}{16}$	$7\frac{3}{4}$	$7\frac{1}{16}$	$7\frac{7}{16}$	$7\frac{1}{8}$	$7\frac{5}{16}$	7	$7\frac{5}{16}$	$6\frac{13}{16}$	$7\frac{1}{16}$	$6\frac{7}{8}$	$7\frac{1}{8}$
1895	5	$5\frac{3}{16}$	5	$5\frac{3}{16}$	$5\frac{1}{16}$	$5\frac{7}{8}$	$5\frac{3}{4}$	$6\frac{3}{8}$	$6\frac{3}{16}$	7	$6\frac{5}{8}$	7
1896	$7\frac{13}{16}$	8	$7\frac{1}{2}$	8	$7\frac{3}{8}$	$7\frac{13}{16}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{3}{8}$	$7\frac{3}{4}$	$6\frac{13}{16}$	$7\frac{3}{8}$
1897	$6\frac{7}{8}$	7	$6\frac{11}{16}$	$7\frac{3}{16}$	$6\frac{15}{16}$	$7\frac{3}{16}$	$6\frac{15}{16}$	$7\frac{9}{16}$	$7\frac{5}{16}$	$7\frac{9}{16}$	$7\frac{3}{8}$	$7\frac{3}{8}$
1898	$5\frac{3}{16}$	$5\frac{3}{8}$	$5\frac{1}{4}$	$5\frac{11}{16}$	$5\frac{7}{16}$	$5\frac{3}{4}$	$5\frac{9}{16}$	$5\frac{3}{4}$	$5\frac{11}{16}$	$6\frac{1}{16}$	$5\frac{7}{8}$	$6\frac{1}{16}$
1899	$5\frac{3}{16}$	$5\frac{3}{4}$	$5\frac{3}{4}$	6	$5\frac{11}{16}$	$6\frac{1}{16}$	$5\frac{5}{8}$	$5\frac{3}{4}$	$5\frac{11}{16}$	$5\frac{7}{8}$	$5\frac{1}{2}$	$5\frac{3}{4}$
1900	$7\frac{1}{4}$	$7\frac{3}{4}$	$7\frac{7}{8}$	9	9	$9\frac{7}{16}$	$9\frac{1}{8}$	$9\frac{1}{2}$	$8\frac{13}{16}$	$9\frac{1}{2}$	$8\frac{13}{16}$	$9\frac{13}{16}$
1901	$9\frac{5}{16}$	$9\frac{11}{16}$	$9\frac{1}{16}$	$9\frac{5}{16}$	$7\frac{15}{16}$	$9\frac{1}{16}$	8	$8\frac{5}{16}$	$7\frac{9}{16}$	8	$7\frac{3}{4}$	$8\frac{7}{16}$
1902	$7\frac{3}{4}$	8	$7\frac{13}{16}$	$8\frac{3}{16}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{9}{16}$	$9\frac{3}{4}$	$9\frac{1}{8}$	$9\frac{3}{4}$	$8\frac{15}{16}$	$9\frac{5}{16}$
1903	$8\frac{7}{16}$	$8\frac{7}{8}$	$8\frac{7}{8}$	$9\frac{7}{8}$	$9\frac{9}{16}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$10\frac{3}{16}$	$10\frac{3}{16}$	$11\frac{11}{16}$	$11\frac{11}{16}$	$13\frac{5}{8}$
1904	13	$15\frac{15}{16}$	$13\frac{1}{4}$	$16\frac{7}{16}$	14	16	$13\frac{7}{8}$	$15\frac{5}{16}$	$12\frac{5}{8}$	$13\frac{7}{8}$	$10\frac{3}{4}$	$12\frac{1}{8}$
1905	$6\frac{5}{8}$	7	7	$7\frac{11}{16}$	$7\frac{1}{4}$	$7\frac{11}{16}$	$7\frac{3}{8}$	$7\frac{5}{16}$	$7\frac{1}{2}$	$8\frac{7}{16}$	$8\frac{1}{4}$	$9\frac{9}{16}$
1906	$11\frac{3}{16}$	$11\frac{3}{4}$	$10\frac{9}{16}$	$10\frac{7}{8}$	$10\frac{1}{2}$	$11\frac{1}{4}$	$11\frac{1}{8}$	$11\frac{7}{16}$	11	$11\frac{7}{16}$	$10\frac{3}{16}$	$11\frac{1}{8}$

Year.	July.		August.		September.		October.		November.		December.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1890	$11\frac{7}{16}$	$11\frac{3}{4}$	$10\frac{3}{8}$	$11\frac{3}{4}$	$9\frac{3}{4}$	$10\frac{1}{4}$	$9\frac{11}{16}$	$10\frac{1}{16}$	$9\frac{1}{16}$	$9\frac{9}{16}$	$8\frac{13}{16}$	$9\frac{1}{8}$
1891	$7\frac{3}{4}$	$7\frac{15}{16}$	$7\frac{5}{8}$	8	8	$8\frac{1}{2}$	$7\frac{15}{16}$	$8\frac{3}{8}$	$7\frac{3}{8}$	$7\frac{7}{8}$	7	$7\frac{1}{2}$
1892	7	$7\frac{3}{16}$	$6\frac{15}{16}$	$7\frac{3}{16}$	$6\frac{15}{16}$	$7\frac{7}{16}$	$7\frac{7}{16}$	$7\frac{13}{16}$	$7\frac{11}{16}$	$9\frac{7}{8}$	$9\frac{5}{16}$	$9\frac{11}{16}$
1893	$7\frac{7}{16}$	$7\frac{3}{4}$	$6\frac{13}{16}$	$7\frac{5}{8}$	$7\frac{5}{16}$	$8\frac{3}{16}$	$7\frac{5}{8}$	$8\frac{1}{8}$	$7\frac{7}{16}$	$7\frac{3}{4}$	$7\frac{1}{8}$	$7\frac{9}{16}$
1894	$6\frac{5}{8}$	$6\frac{7}{8}$	$6\frac{7}{16}$	$6\frac{5}{8}$	$5\frac{11}{16}$	$6\frac{1}{2}$	$5\frac{3}{16}$	$5\frac{3}{4}$	$4\frac{7}{8}$	$5\frac{1}{2}$	$5\frac{1}{16}$	$5\frac{5}{16}$
1895	$6\frac{1}{2}$	$6\frac{3}{4}$	$6\frac{9}{16}$	$7\frac{11}{16}$	$7\frac{9}{16}$	$8\frac{3}{4}$	$8\frac{5}{16}$	$9\frac{3}{16}$	$8\frac{1}{16}$	$8\frac{5}{8}$	$7\frac{3}{4}$	$8\frac{3}{16}$
1896	$6\frac{1}{2}$	$6\frac{13}{16}$	$6\frac{13}{16}$	8	$7\frac{5}{8}$	$8\frac{1}{8}$	$7\frac{1}{8}$	$7\frac{5}{8}$	$7\frac{3}{16}$	$7\frac{1}{2}$	$6\frac{11}{16}$	$7\frac{3}{8}$
1897	$7\frac{11}{16}$	$7\frac{13}{16}$	$7\frac{1}{16}$	$7\frac{11}{16}$	$6\frac{1}{16}$	$7\frac{1}{16}$	$5\frac{1}{2}$	$6\frac{1}{8}$	$5\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{1}{4}$	$5\frac{3}{8}$
1898	$5\frac{5}{8}$	$5\frac{7}{8}$	$5\frac{3}{8}$	$5\frac{11}{16}$	$4\frac{7}{8}$	$5\frac{3}{8}$	$4\frac{13}{16}$	5	$4\frac{3}{4}$	$5\frac{1}{16}$	5	$5\frac{1}{4}$
1899	$5\frac{5}{8}$	$5\frac{3}{4}$	$5\frac{3}{4}$	$5\frac{15}{16}$	$5\frac{3}{4}$	$6\frac{1}{2}$	$6\frac{3}{4}$	$6\frac{15}{16}$	$6\frac{7}{8}$	$7\frac{7}{16}$	$7\frac{3}{16}$	$7\frac{1}{2}$
1900	$9\frac{7}{8}$	$10\frac{1}{4}$	$9\frac{3}{8}$	$10\frac{1}{4}$	$9\frac{3}{8}$	$11\frac{1}{8}$	$8\frac{13}{16}$	$10\frac{5}{16}$	9	$9\frac{7}{8}$	$9\frac{1}{4}$	$9\frac{13}{16}$
1901	$8\frac{1}{8}$	$8\frac{7}{16}$	8	$8\frac{15}{16}$	$7\frac{15}{16}$	$8\frac{5}{8}$	$7\frac{7}{16}$	$8\frac{5}{16}$	$7\frac{1}{4}$	$7\frac{7}{16}$	$7\frac{3}{4}$	$8\frac{1}{16}$
1902	$8\frac{5}{8}$	$9\frac{1}{16}$	$8\frac{3}{8}$	$8\frac{5}{8}$	$8\frac{3}{16}$	$8\frac{5}{8}$	8	$8\frac{1}{2}$	$7\frac{5}{8}$	8	$7\frac{15}{16}$	$8\frac{3}{8}$
1903	$12\frac{5}{8}$	$13\frac{5}{8}$	$12\frac{1}{2}$	$13\frac{1}{4}$	$9\frac{3}{4}$	$12\frac{1}{2}$	$9\frac{1}{8}$	$10\frac{1}{4}$	10	$11\frac{3}{16}$	$11\frac{1}{2}$	$13\frac{5}{8}$
1904	$10\frac{1}{2}$	$11\frac{1}{16}$	$10\frac{1}{4}$	$11\frac{3}{16}$	10	$11\frac{3}{16}$	$9\frac{1}{2}$	$10\frac{3}{16}$	$8\frac{7}{8}$	$9\frac{11}{16}$	$6\frac{1}{2}$	$8\frac{9}{16}$
1905	$9\frac{3}{4}$	$11\frac{1}{8}$	$10\frac{3}{8}$	$10\frac{9}{16}$	$10\frac{1}{8}$	$10\frac{7}{16}$	$9\frac{3}{4}$	$10\frac{11}{16}$	$10\frac{3}{4}$	$11\frac{9}{16}$	$11\frac{3}{8}$	$12\frac{1}{16}$
1906	$10\frac{5}{8}$	$11\frac{1}{8}$	$9\frac{3}{16}$	$10\frac{5}{8}$	$9\frac{3}{8}$	$9\frac{1}{8}$	$9\frac{11}{16}$	$11\frac{3}{8}$	$9\frac{5}{8}$	$11\frac{3}{8}$	$10\frac{1}{8}$	$11\frac{3}{8}$

COTTON CROP OF THE UNITED STATES, 1790–1906.

Intelligent use of the following table depends upon observing these explanations:

Year.—The year mentioned is, for production, that of planting and growth; but ginning continues into the following calendar year. When, in want of figures for production, a commercial crop is taken, this represents the trade movement beginning September 1 of the growth year and ending August 31 of the following year. The year for exports and imports begins October 1 of the growth year for the period 1790–1842 (1842 is a nine-months year); July 1 for 1843–1866 (1866 is a fourteen-months year); and September 1 for 1867–1905; except that the average price of exports per pound given for the years 1791–1800 (average for following and nearly coincident calendar years adopted) is derived from a report of Secretary of Treasury Woodbury (Ex. Doc. No. 146, 24th Cong., 1st sess.).

Production—number of running bales.—1790–1834 and 1839, production, total net weight in pounds divided by net weight per bale; 1835–1838, 1840–1848, 1850–1858, 1860, 1865–1868, 1870–1878, 1880–1888, 1890–1898, commercial crop, Latham, Alexander & Company's Cotton Movement and Fluctuation; 1849, 1859, 1869, 1879, 1889, 1899-1906, production, Census; 1861–1864, commercial crop, Production and Price of Cotton for One Hundred Years, by James L. Watkins, Bulletin No. 9, Bureau of Statistics, United States Department of Agriculture. Linters included, 1899–1906. Number of running bales of linters, 1899, 114,544; 1900, 143,500; 1901, 166,026; 1902, 196,223; 1903, 195,752; 1904, 245,973; 1905, 230,497; 1906, 322,064.

Production—500-pound bales.—Linters included, 1899–1906, with same number of bales as above for 1899–1902; 500-pound bales in 1903, 194,486; 1904, 241,942; 1905, 229,539; 1906, 321,689.

Production—net weight per bale.—1790–1898, Bulletin No. 9, above, and Latham, Alexander & Company, above; 1899–1906, Census. Linters not included.

Production—total net weight.—1790–1834, production, report of Secretary Woodbury, above; 1839, production, Census; 1835–1838, 1840–1848, 1850–1858, 1860–1868, 1870–1878, 1880–1888, 1890–1898, commercial crop, and 1849, 1859, 1869, 1879, 1889, 1899-1906, production, number of bales multiplied by average net weight per bale. Linters not included.

Price per pound of lint.—1869–1898, farm price, December 1, Bureau of Statistics, Department of Agriculture, specific inquiry; 1899, Census, total farm value divided by total net weight; 1900–1901, no information; 1902–1906, Census, New Orleans Cotton Exchange value for upland cotton, computed by multiplying total net weight by mean exchange price for estimated average grade, and Charleston and Savannah Cotton Exchange value for sea-island cotton. Linters not included.

Total value of lint.—Total net weight multiplied by price per pound, except for 1899. Linters not included, because included in value of seed, which was in total as follows for the only years for which ascertainable: At the farm, 1899, $46,950,575; at the mill, 1902, $80,209,194; 1903, $84,049,406; 1904, $90,931,250; 1905, $75,464,515; 1906, $81,335,699.

Consumption.—Linters included, 1899–1905. No account taken of stocks at beginning and end of year. The figures are from the formula of production plus net imports minus domestic exports, and do not stand for actual consumption for any certain year, concerning which see Bul. No. 63, Bureau of the Census.

Domestic exports.—Including reexports, 1790–1800, not including reexports, 1801–1819, American State Papers; 1820–1905, Bureau of Statistics, Department of Commerce and Labor. Linters included, 1897–1905; uncertain whether included before 1897 and after this class of cotton first appeared in trade, soon after 1870.

Net imports.—Imports, including reexports, 1790–1800, not including reexports, 1801–1818, American State Papers; 1819, Report of Secretary Woodbury, above; 1820–1905, Bureau of Statistics, Department of Commerce and Labor; except that the imports given for the years 1791–1793 are for the following calendar years, being nearly coincident with the commercial crop years.

Linters.—1899–1906, included in production of running bales and equivalent 500-pound bales, and in consumption. Included in domestic exports, as explained above.

Gold values.—All values have been reduced to gold for 1862–1878.

Bureau of the Census.—In the preparation of the following table the Bureau of Statistics of the Department of Agriculture has been favored with the cooperation of the Bureau of the Census of the Department of Commerce and Labor.

Production, value, consumption, domestic exports, and net imports of cotton for the United States, 1790–1906.

Year.	Production or trade.				Value of lint at farm or exchange.		Retained for consumption, in 500-pound bales, gross weight.	Domestic exports, beginning in year mentioned.			Net imports, beginning in year mentioned.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight per bale of lint.	Total net weight of lint.	Price per pound.	Total value.		Gross weight.	Equivalent 500-pound bales, gross weight.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.
	Number.	*Number.*	*Pounds.*	*Pounds (000 omitted).*	*Cents.*	*Dollars.*	*Number.*	*Pounds (000 omitted).*	*Number.*	*Cents.*	*Pounds (000 omitted).*	*Number.*
1790	6,667	3,138	225	1,500	......	......	3,457	189	378	25.0	333	697
1791	8,889	4,184	225	2,000	......	......	5,020	138	276	29.0	532	1,112
1792	13,333	6,276	225	3,000	......	......	10,681	549	1,098	32.0	2,630	5,503
1793	22,222	10,460	225	5,000	......	......	12,023	1,782	3,564	33.0	2,451	5,127
1794	35,556	16,736	225	8,000	......	......	15,914	4,707	9,414	36.5	4,107	8,592
1795	35,556	16,736	225	8,000	......	......	13,259	6,107	12,214	36.5	4,176	8,737
1796	44,444	20,921	225	10,000	......	......	20,681	3,788	7,576	34.0	3,507	7,336
1797	48,889	23,013	225	11,000	......	......	12,054	9,360	18,720	39.0	3,710	7,761
1798	66,667	31,381	225	15,000	......	......	19,849	9,532	19,064	44.0	3,600	7,532
1799	88,889	41,841	225	20,000	......	......	15,131	17,790	35,580	28.0	4,240	8,870
1800	153,509	73,222	228	35,000	......	......	40,096	20,911	41,822	44.0	4,157	8,696
1801	210,526	100,418	228	48,000	......	......	52,480	23,884	47,768	19.1	a 81	a 170
1802	231,092	115,063	238	55,000	......	......	38,486	37,712	75,424	19.3	a 551	a 1,153
1803	222,222	125,523	270	60,000	......	......	55,638	35,034	70,068	20.1	87	183
1804	261,044	135,983	249	65,000	......	......	59,659	38,390	76,780	24.6	218	456
1805	304,348	146,444	230	70,000	......	......	76,091	35,657	71,314	23.4	459	961
1806	235,714	167,364	280	80,000	......	......	40,961	63,944	127,888	22.3	710	1,485
1807	289,855	167,364	276	80,000	......	......	152,401	10,630	21,260	20.9	3,010	6,297
1808	334,821	156,904	224	75,000	......	......	53,323	50,990	101,980	16.7	a 765	a 1,601
1809	328,000	171,548	250	82,000	......	......	b 15,534	93,261	186,522	16.2	a 268	a 560
1810	286,195	177,824	297	85,000	......	......	54,139	62,058	124,116	15.6	206	431
1811	325,203	167,364	246	80,000	......	......	110,487	28,887	57,774	10.7	429	897
1812	304,878	156,904	246	75,000	......	......	121,817	19,110	38,220	12.2	1,497	3,133
1813	304,878	156,904	246	75,000	......	......	121,547	17,729	35,458	15.1	48	101
1814	254,545	146,444	275	70,000	......	......	b 19,820	82,999	165,998	21.1	a 127	a 266
1815	369,004	209,205	271	100,000	......	......	45,267	81,947	163,894	29.4	a 21	a 44
1816	439,716	259,414	282	124,000	......	......	90,164	85,649	171,298	26.4	979	2,048
1817	465,950	271,967	279	130,000	......	......	90,111	92,471	184,942	33.2	1,475	3,086
1818	446,429	261,506	280	125,000	......	......	81,058	87,997	175,994	24.0	a 2,129	a 4,454
1819	632,576	349,372	264	167,000	......	......	89,081	127,860	255,720	17.4	a 2,185	a 4,571
1820	575,540	334,728	278	160,000	......	......	85,369	124,893	249,786	16.1	204	427
1821	636,042	376,569	283	180,000	......	......	87,023	144,675	289,350	16.6	a 94	a 196
1822	704,698	439,331	298	210,000	......	......	91,995	173,723	347,446	11.8	53	110

a Excess of foreign exports over total imports.

b Excess of domestic exports over production and net imports.

Production, value, consumption, domestic exports, and net imports of cotton for the United States, 1790–1906—Continued.

Year.	Production or trade.				Value of lint at farm or exchange.		Retained for consumption, in 500-pound bales, gross weight.	Domestic exports, beginning in year mentioned.			Net imports, beginning in year mentioned.	
	Running bales, counting round as half bales.	Equivalent 500-pound bales, gross weight.	Net weight per bale of lint.	Total net weight of lint.	Price per pound.	Total value.		Gross weight.	Equivalent 500-pound bales, gross weight.	Export price per pound, gross weight.	Net weight.	Equivalent 500-pound bales, gross weight.
	Number.	*Number.*	*Pounds.*	*Pounds (000 omitted).*	*Cents.*	*Dollars.*	*Number.*	*Pounds (000 omitted).*	*Number.*	*Cents.*	*Pounds (000 omitted).*	*Number.*
1823	656,028	387,029	282	185,000	.....	.....	103,221	142,370	284,740	15.4	446	932
1824	751,748	440,791	286	215,000	.....	.....	96,917	176,450	352,900	20.9	13	26
1825	817,508	533,173	312	255,000	.....	.....	124,182	204,535	409,070	12.2	38	79
1826	1,057,402	732,218	331	350,000	.....	.....	143,672	294,310	588,620	10.0	35	74
1827	805,970	561,854	335	270,000	.....	.....	141,271	210,590	421,180	10.7	285	597
1828	953,079	679,916	341	325,000	.....	.....	150,202	264,837	529,674	10.0	a 19	a 40
1829	1,076,096	763,598	339	365,000	.....	.....	167,058	298,459	596,918	9.9	181	378
1830	1,026,393	732,218	341	350,000	.....	.....	178,280	276,980	553,960	9.1	10	22
1831	1,069,444	805,439	360	385,000	.....	.....	160,987	322,215	644,430	9.8	a 10	a 22
1832	1,114,280	815,600	350	390,000	.....	.....	166,571	324,699	649,398	11.1	33	69
1833	1,225,895	930,362	363	445,000	.....	.....	161,834	384,718	769,436	12.9	147	308
1834	1,253,406	962,343	367	460,000	.....	.....	189,190	387,359	774,718	16.8	752	1,574
1835	1,360,725	1,061,821	373	507,550	.....	.....	214,986	423,631	847,262	16.8	204	427
1836	1,423,930	1,129,016	379	539,669	.....	.....	230,082	444,212	888,424	14.2	a 244	a 510
1837	1,801,497	1,428,584	379	682,767	.....	.....	236,835	595,952	1,191,904	10.3	170	355
1838	1,360,532	1,092,980	384	522,114	.....	.....	266,051	413,624	827,248	14.8	153	319
1839	2,063,915	1,653,722	383	790,479	.....	.....	166,137	743,941	1,487,882	8.6	142	297
1840	1,634,954	1,347,640	394	644,172	.....	.....	288,442	530,204	1,060,408	10.2	578	1,210
1841	1,683,574	1,398,282	397	668,579	.....	.....	228,955	584,717	1,169,434	8.1	51	107
1842	2,378,875	2,035,381	409	972,960	.....	.....	452,722	792,297	1,584,594	6.2	877	1,835
1843	2,030,409	1,750,000	412	836,529	.....	.....	493,311	663,633	1,327,266	8.1	247	517
1844	2,394,503	2,078,910	415	993,719	.....	.....	332,418	872,906	1,745,812	5.9	a 325	a 680
1845	2,100,537	1,806,110	411	863,321	.....	.....	711,380	547,558	1,095,116	7.8	185	386
1846	1,778,651	1,603,763	431	766,599	.....	.....	540,445	527,220	1,054,440	10.1	58	122
1847	2,439,786	2,128,433	417	1,017,391	.....	.....	600,443	814,274	1,628,548	7.6	267	558
1848	2,866,938	2,615,031	436	1,249,985	.....	.....	561,849	1,026,602	2,053,204	6.5	10	22
1849	2,469,093	2,215,985	429	1,059,241	.....	.....	915,706	635,382	1,270,764	11.3	232	485
1850	2,454,442	2,136,083	416	1,021,048	.....	.....	281,039	927,237	1,854,474	12.1	158	330
1851	3,126,310	2,799,290	428	1,338,061	.....	.....	613,340	1,093,231	2,186,462	8.0	245	512
1852	3,416,214	3,130,338	438	1,496,302	.....	.....	908,621	1,111,570	2,223,140	9.8	680	1,423
1853	3,074,979	2,766,194	430	1,322,241	.....	.....	791,169	987,833	1,975,666	9.5	545	1,141
1854	2,982,634	2,708,082	434	1,294,463	.....	.....	695,657	1,008,425	2,016,850	8.7	2,115	4,425
1855	3,665,557	3,220,782	420	1,539,534	.....	.....	590,213	1,351,432	2,702,864	9.5	1,097	2,295
1856	3,093,737	2,873,080	444	1,373,019	.....	.....	778,794	1,048,282	2,096,564	12.6	802	1,678
1857	3,257,339	3,012,016	442	1,439,744	.....	.....	774,768	1,118,624	2,237,248	11.7	.....	.....

1858	4,018,914	3,758,273	447	1,796,455			985,335	1,386,469	2,772,938	11.6		
1859	5,387,052	5,195,462	461	2,483,431			1,660,090	1,767,686	3,535,372	10.9		
1860	3,849,469	3,841,416	477	1,836,197			3,226,384	307,516	615,032	11.1		
1861	4,500,000	4,490,586	477	2,146,500			4,542,187	5,065	10,130	22.9	29,507	61,731
1862	1,000,000	1,596,653	477	763,200			1,641,578	11,385	22,770	42.6	32,358	67,695
1863	450,000	449,059	477	214,650			477,476	11,994	23,988	52.8	25,050	52,405
1864	300,000	299,372	477	143,100			350,382	8,894	17,788	38.1	32,886	68,798
1865	2,269,316	2,093,658	441	1,000,768			802,834	650,573	1,301,146	30.8	4,934	10,322
1866	2,097,254	1,948,077	444	931,181			545,344	700,849	1,401,698	21.4	a 495	a 1,035
1867	2,519,554	2,345,610	445	1,121,202			843,199	751,378	1,502,756	13.7	165	345
1868	2,366,467	2,198,141	444	1,050,711			899,563	650,224	1,300,448	18.6	894	1,870
1869	3,011,996	2,772,549	440	1,325,278	16.5	218,670,910	787,867	993,854	1,987,708	19.5	1,446	3,026
1870	4,352,317	4,024,527	442	1,923,724	12.1	232,770,618	1,103,573	1,461,378	2,922,756	13.3	861	1,802
1871	2,974,351	2,756,564	443	1,317,637	17.9	235,857,111	938,002	912,468	1,824,936	17.5	3,047	6,374
1872	3,930,508	3,650,932	444	1,745,146	16.5	287,949,016	1,190,358	1,235,295	2,470,590	16.4	4,788	10,016
1873	4,170,388	3,873,750	444	1,851,652	14.1	261,082,970	1,194,661	1,341,315	2,682,630	14.6	1,693	3,541
1874	3,832,991	3,528,276	440	1,686,516	13.0	219,247,085	1,027,942	1,252,059	2,504,118	13.3	1,809	3,784
1875	4,632,313	4,302,818	444	2,056,747	11.1	228,298,914	1,269,666	1,518,825	3,037,650	11.3	2,150	4,498
1876	4,474,069	4,118,390	440	1,968,590	9.9	194,890,446	1,283,804	1,419,709	2,839,418	11.1	2,310	4,832
1877	4,773,865	4,494,224	450	2,148,239	10.5	225,565,121	1,301,832	1,598,719	3,197,438	11.0	2,412	5,046
1878	5,074,155	4,745,078	447	2,268,147	8.2	185,988,077	1,459,961	1,645,083	3,290,166	10.0	2,414	5,049
1879	5,755,359	5,466,387	454	2,612,933	10.2	266,519,165	1,731,213	1,871,376	3,742,752	11.6	3,622	7,578
1880	6,605,750	6,356,998	460	3,038,645	9.8	297,787,210	1,908,949	2,226,748	4,453,496	11.3	2,604	5,447
1881	5,456,048	5,136,447	450	2,455,222	10.0	245,522,160	1,763,186	1,688,261	3,376,522	11.5	1,559	3,261
1882	6,949,756	6,833,442	470	3,266,385	9.9	323,372,147	2,246,826	2,295,666	4,591,332	10.8	2,254	4,716
1883	5,713,200	5,521,963	462	2,639,498	9.0	237,554,856	1,799,842	1,866,684	3,733,368	10.6	5,376	11,247
1884	5,706,165	5,491,288	460	2,624,836	9.2	241,484,903	1,768,262	1,865,085	3,730,170	10.7	3,415	7,144
1885	6,575,691	6,369,341	463	3,044,545	8.5	258,786,319	2,176,965	2,100,323	4,200,646	9.9	3,953	8,270
1886	6,505,087	6,314,561	464	3,018,360	8.1	247,140,771	2,020,571	2,150,771	4,301,542	9.5	3,610	7,552
1887	7,046,833	6,884,667	467	3,290,871	8.5	279,724,037	2,377,396	2,259,627	4,519,254	9.9	5,728	11,983
1888	6,938,290	6,923,775	477	3,309,564	8.5	281,312,968	2,208,867	2,365,096	4,730,192	10.0	7,306	15,284
1889	7,472,511	7,472,511	478	3,571,860	8.3	296,464,401	2,561,923	2,464,461	4,928,922	10.2	8,764	18,334
1890	8,652,597	8,562,089	473	4,092,678	8.6	351,970,341	2,757,449	2,925,110	5,850,220	10.0	21,787	45,580
1891	9,035,379	8,940,867	473	4,273,734	7.3	311,982,601	3,108,461	2,948,400	5,896,800	8.8	30,780	64,394
1892	6,700,365	6,658,313	475	3,182,673	8.4	267,344,564	2,258,798	2,242,625	4,485,250	8.5	40,981	85,735
1893	7,549,817	7,486,639	474	3,578,613	7.0	250,502,928	2,238,750	2,653,647	5,307,294	7.8	28,396	59,405
1894	9,901,251	10,025,534	484	4,792,205	4.6	220,441,452	3,163,561	3,480,686	6,961,372	5.8	47,513	99,399
1895	7,157,346	7,142,372	477	3,414,054	7.6	259,468,107	2,492,869	2,380,752	4,761,504	8.2	53,537	112,001
1896	8,757,964	8,739,642	477	4,177,549	6.6	275,718,223	2,728,170	3,063,092	6,126,184	7.4	54,832	114,712
1897	11,199,994	11,293,718	482	5,398,397	6.6	356,294,209	3,560,052	3,919,734	7,839,468	6.0	50,573	105,802
1898	11,274,840	11,534,303	489	5,513,397	5.7	314,263,615	3,982,244	3,827,641	7,655,282	5.6	49,341	103,223
1899	9,507,786	9,459,935	476	4,467,097	7.24	323,758,171	3,373,173	3,110,770	6,221,540	7.9	64,424	134,778
1900	10,245,602	10,266,527	480	4,846,471			3,522,221	3,430,458	6,860,916	9.3	55,739	116,610
1901	9,478,546	9,675,771	489	4,550,950			2,937,153	3,464,349	6,928,698	8.3	90,858	190,080
1902	10,784,473	10,827,168	481	5,091,641	8.28	421,687,941	4,015,401	3,480,440	6,960,880	9.0	71,276	149,113
1903	10,015,721	10,045,615	486	4,716,591	12.22	576,499,824	3,855,669	3,145,122	6,290,244	12.0	47,942	100,298
1904	13,697,310	13,679,954	478	6,426,698	8.73	561,100,386	4,690,522	4,559,807	9,119,614	8.9	62,227	130,182
1905	10,725,602	10,804,556	482	5,060,205	11.00	556,833,818	3,962,526	3,487,747	6,975,494	11.0	63,796	133,464
1906	13,305,265	13,595,498	489	6,354,108	10.08	640,311,538						

a Excess of foreign exports over total imports.

Closing prices middling upland cotton per pound, in leading cities of the United States, 1902–1906.

Date	New York. Low	New York. High	New Orleans. Low	New Orleans. High	Memphis. Low	Memphis. High	Galveston. Low	Galveston. High	Savannah. Low	Savannah. High	Charleston. Low	Charleston. High	Wilmington. Low	Wilmington. High	Norfolk. Low	Norfolk. High
1902.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Jan	[illegible]	[illegible]	[illegible]	8	7	[illegible]	[illegible]	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7¾	[illegible]	8
Feb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8¼	[illegible]	8½
Mar	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8⅝	8¼	[illegible]
Apr	9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8¾	9¾
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	9½	9 3/16	9¾
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	[illegible]	[illegible]	[illegible]	9	9½	9¼	9¼
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	9	9⅞
Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8¾	8¾	9 1/16
Sept	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8½	8½	9
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8 9/16
Nov	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8⅜
Dec	[illegible]	[illegible]	[illegible]	[illegible]	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8⅛	8 3/16	8½
1903.																
Jan	8.85	9.05	[illegible]	[illegible]	[illegible]	[illegible]	8⅝	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8⅝	9
Feb	9.05	10.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	10
Mar	9.90	10.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9¾	10
Apr	[illegible]	10.75	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	10	[illegible]	10	[illegible]	[illegible]	10	10½
May	[illegible]	12.15	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	10	[illegible]	10	11	10	10⅜	10⅜	11⅞
June	11.50	13.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	11	....	10½	11⅝	13
July	11.60	13.50	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	[illegible]	....	....	....	....	12	13
Aug	12.75	12.75	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	[illegible]	12½	12¼	....	....	12¼	12½
Sept	11.25	13.00	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9¾	12½
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	10	9	[illegible]	9¼	10 7/16
Nov	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	10	11	10½	11⅜
Dec	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	11	[illegible]	[illegible]	[illegible]
1904.																
Jan	[illegible]	[illegible]	13	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12⅞	[illegible]	12⅞	15	13	16
Feb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	16	13	15¼	13	16½
Mar	14.00	[illegible]	14	[illegible]	14	[illegible]	14	[illegible]	[illegible]	[illegible]	14¼	[illegible]	14	15⅝	14	16¼
Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....	14	15¼
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....	....	....	13	14
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	[illegible]	[illegible]	....	....	....	....	10⅝	12⅛
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	....	....	....	....	10⅝	11¼
Aug	10.45	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	11	....	....	....	....	10⅝	11
Sept	[illegible]	[illegible]	10	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	10	10 7/16	10 5/16	10 5/16	10	11
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....	[illegible]	[illegible]
Nov	9.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	[illegible]	9	9⅝	9	[illegible]
Dec	[illegible]	9.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	....	[illegible]	8⅝
1905.																
Jan	7.00	[illegible]	[illegible]	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	[illegible]	[illegible]	....	....	[illegible]	[illegible]
Feb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7⅞
Mar	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8
Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	10.15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	8⅝	[illegible]	[illegible]
July	10.05	11.40	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	....	....	[illegible]	11
Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	....	[illegible]	[illegible]	11
Sept	10.65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nov	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dec	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	12
1906.																
Jan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	11	[illegible]	11	[illegible]	[illegible]	[illegible]
Feb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
Mar	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	11	[illegible]	[illegible]
Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	11	[illegible]	11	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10⅝	[illegible]	[illegible]	[illegible]	11	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	....	....	[illegible]	[illegible]	11	[illegible]
Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	[illegible]	9	[illegible]	[illegible]	[illegible]
Sept	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9	[illegible]	[illegible]	[illegible]
Oct	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	11	[illegible]	[illegible]
Nov	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]
Dec	[illegible]	11.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

International trade in cotton-seed oil, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Belgium	Jan. 1	878,907	877,851	670,655	714,319	1,252,803
Egypt	Jan. 1	197,013	479,155	426,148	397,446	249,843
France	Jan. 1	495,296	375,361	394,169	213,087	511,743
Netherlands	Jan. 1	37,450	44,328	230,762	168,425	168,686
United Kingdom	Jan. 1	5,206,109	8,299,636	6,725,236	4,865,745	5,323,636
United States	July 1	33,042,848	35,642,994	29,013,743	51,535,580	43,793,519
Other countries		131,000	72,000	11,000	1,000	42,000
Total		39,988,623	45,791,325	37,471,713	57,895,602	51,342,230

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Algeria	Jan. 1	459,831	395,948	358,204	625,340	1,163,468
Australia	Jan. 1	122,041	64,252	75,799	105,630	178,797
Austria-Hungary	Jan. 1	4,025,182	3,367,889	4,253,976	4,505,589	5,499,759
Belgium	Jan. 1	2,138,236	2,473,051	1,450,415	1,591,592	3,037,884
Brazil	Jan. 1	1,224,666	1,174,250	923,463	840,327	[b] 759,879
Canada	July 1	1,326,638	1,112,940	905,169	1,082,099	1,337,763
Egypt	Jan. 1	325,779	115,782	256,211	149,587	416,962
France	Jan. 1	11,221,447	7,464,358	5,691,156	6,130,298	11,082,265
Germany [c]	Jan. 1	14,831,666	15,889,198	11,420,314	11,347,562	16,767,840
Italy	Jan. 1	2,279,493	777,430	1,051,462	1,225,569	[b] 3,429,991
Malta	Apr. 1	238,800	254,803	364,105	285,903	[d] 281,422
Martinique	Jan. 1	402,324	166,981	285,034	277,114	[d] 282,863
Mexico	July 1	3,405,398	3,559,783	4,066,361	3,158,044	[b] 3,794,244
Netherlands	Jan. 1	5,398,204	5,769,104	3,271,886	3,183,920	4,764,653
Senegal	Jan. 1	395,224	412,946	351,119	294,713	[d] 363,500
United Kingdom	Jan. 1	337,774	337,774	337,774	270,662	404,887
Uruguay	July 1	339,155	297,602	352,063	[b] 329,607	[d] 329,607
Other countries		535,000	463,000	541,000	699,000	[d] 560,000
Total		49,006,858	44,097,091	35,955,511	36,102,556	54,455,784

[a] See "General note," p. 546.
[b] Preliminary figures.
[c] Not including free ports.
[d] Average, 1901–1904.

TOBACCO.

Tobacco crop of countries named, 1901–1905.

[Production for South America (especially Brazil) largely understated, because domestic consumption is unknown. No statistics for China, Persia, Central America (except Guatemala), West Indies (except Cuba and Porto Rico), and several less important tobacco-growing countries.]

Country.	1901.	1902.	1903.	1904.	1905.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	818,953,000	821,824,000	815,972,000	660,461,000	633,034,000
Noncontiguous—Porto Rico	8,000,000	8,000,000	5,000,000	5,000,000	6,000,000
Total United States (except Philippine Islands)	826,953,000	829,824,000	820,972,000	665,461,000	639,034,000
Canada:					
Ontario	3,114,000	3,071,000	2,423,000	3,035,000	[a] 6,275,000
Quebec	[b] 5,000,000	[b] 5,000,000	[b] 5,000,000	[b] 5,000,000	[a] 3,100,000
Total Canada	8,114,000	8,071,000	7,423,000	8,035,000	9,375,000
Cuba	45,892,000	57,177,000	[a] 38,731,000	[a] 42,421,000	[a] 48,783,000
Guatemala	1,051,000	1,063,000	1,065,000	1,983,000	[c] 1,300,000
Mexico	26,256,000	[a] 20,000,000	29,156,000	28,880,000	[a] 23,000,000
Total North America	908,266,000	916,135,000	897,347,000	746,780,000	721,492,000

[a] Unofficial estimate.
[b] Estimated from census statistics for 1900 and unofficial estimate for 1905.
[c] Average production.

Tobacco crop of countries named, 1901–1905—Continued.

Country.	1901.	1902.	1903.	1904.	1905.
SOUTH AMERICA.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina [a]	28,000,000	31,000,000	22,000,000	31,000,000	43,000,000
Bolivia [b]	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Brazil [c]	73,791,000	99,473,000	51,583,000	52,832,000	44,953,000
Chile [b]	6,000,000	6,000,000	6,000,000	6,000,000	6,000,000
Ecuador [c]	42,000	179,000	399,000	89,000	122,000
Paraguay	[b] 10,000,000	8,510,000	10,296,000	[d] 13,228,000	[b] 10,000,000
Peru [b]	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Total South America	122,333,000	149,662,000	94,778,000	107,649,000	108,575,000
EUROPE.					
Austria-Hungary:					
Austria	9,689,000	12,938,000	15,895,000	14,047,000	15,644,000
Hungary	125,934,000	99,228,000	134,567,000	88,768,000	[b] 112,000,000
Bosnia-Herzegovina	[e] 9,000,000	[e] 9,000,000	[e] 9,000,000	[e] 9,000,000	8,753,000
Total Austria-Hungary	144,623,000	121,166,000	159,462,000	111,815,000	136,397,000
Belgium	10,647,000	11,266,000	9,685,000	13,983,000	16,646,000
Bulgaria	5,590,000	6,423,000	19,060,000	8,914,000	8,080,000
Denmark	293,000	363,000	342,000	[b] 340,000	[b] 340,000
France	55,905,000	54,610,000	57,466,000	37,767,000	[b] 51,000,000
Germany	88,213,000	83,111,000	72,911,000	75,797,000	70,277,000
Greece	[b] 14,000,000	[b] 14,000,000	[b] 14,000,000	[b] 14,000,000	20,000,000
Italy	12,734,000	11,052,000	12,188,000	13,464,000	[b] 12,400,000
Netherlands	2,768,000	2,211,000	1,771,000	[d] 1,500,000	[d] 1,500,000
Roumania	6,249,000	6,096,000	10,113,000	3,999,000	8,694,000
Russia	136,630,000	232,767,000	222,785,000	[b] 200,000,000	[b] 200,000,000
Servia	1,973,000	2,358,000	2,488,000	2,380,000	2,086,000
Sweden	1,680,000	1,636,000	1,706,000	4,118,000	2,713,000
Turkey [f]	[b] 100,000,000	[d] 71,000,000	[d] 110,000,000	[d] 90,000,000	[d] 100,000,000
Total Europe	581,305,000	618,059,000	693,977,000	578,077,000	630,133,000
ASIA.					
British India [d]	450,000,000	450,000,000	450,000,000	450,000,000	450,000,000
Dutch East Indies:					
Borneo	736,000	336,000	163,000	56,000	[b] 300,000
Java	31,414,000	57,958,000	59,274,000	44,991,000	[b] 50,000,000
Sumatra	44,512,000	46,850,000	50,721,000	45,134,000	[b] 45,000,000
Total Dutch East Indies	76,662,000	105,144,000	110,158,000	90,181,000	95,300,000
Japanese Empire:					
Japan	64,652,000	69,029,000	95,151,000	105,853,000	[g] 105,853,000
Formosa	904,000	1,095,000	1,010,000	222,000	[b] 808,000
Total Japanese Empire	65,556,000	70,124,000	96,161,000	106,075,000	106,661,000
Philippine Islands	[h] 38,600,000	37,499,000	[h] 35,900,000	[h] 33,100,000	[h] 38,200,000
Total Asia	630,818,000	662,767,000	692,219,000	679,356,000	690,161,000
AFRICA.					
Algeria	16,657,000	18,863,000	13,013,000	12,492,000	[b] 15,000,000
British Central Africa	[e] 60,000	[e] 60,000	[e] 60,000	[e] 60,000	60,000
Cape of Good Hope	[h] 5,000,000	[h] 5,000,000	[h] 5,000,000	5,309,000	[h] 5,000,000
Mauritius	6,000	26,000	28,000	29,000	13,000
Natal	4,271,000	3,479,000	4,418,000	2,907,000	2,623,000
Orange River Colony	[g] 750,000	[g] 750,000	[g] 750,000	750,000	650,000
Total Africa	26,744,000	28,178,000	23,269,000	21,547,000	23,346,000

[a] Estimated from official data of acreage.
[b] Average production.
[c] Exports.
[d] Unofficial estimate.
[e] Official estimate for 1905.
[f] Including Asiatic Turkey.
[g] Official estimate for 1904.
[h] Estimated from returns for census year.

Tobacco crop of countries named, 1901–1905—Continued.

Country.	1901.	1902.	1903.	1904.	1905.
OCEANIA.					
Australia:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Queensland	452,000	655,000	204,000	69,000	798,000
New South Wales	213,000	221,000	292,000	596,000	562,000
Victoria	35,000	39,000	87,000	95,000	125,000
Total Australian Commonwealth.	700,000	915,000	583,000	760,000	1,485,000
Fiji	47,000	56,000	74,000	58,000	1,000
Total Oceania	747,000	971,000	657,000	818,000	1,486,000
Grand total	2,270,213,000	2,375,772,000	2,402,247,000	2,134,227,000	2,175,193,000

Acreage, production, and value of tobacco in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.
	Acres.	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*
New Hampshire	126	1,785	224,910	17.0	38,235
Vermont	199	1,700	338,300	17.0	57,511
Massachusetts	4,712	1,750	8,246,000	18.5	1,525,510
Connecticut	14,140	1,735	24,532,900	18.0	4,415,922
New York	7,074	1,250	8,842,500	13.8	1,220,265
Pennsylvania	26,000	1,375	35,750,000	13.7	4,897,750
Maryland	29,540	600	17,724,000	6.8	1,205,232
Virginia	108,971	675	73,555,425	8.2	6,031,545
West Virginia	4,005	780	3,123,900	9.2	287,399
North Carolina	120,358	580	69,807,640	10.0	6,980,764
South Carolina	13,400	670	8,978,000	10.5	942,690
Georgia	3,000	675	2,025,000	30.0	607,500
Florida	5,400	875	4,725,000	35.0	1,653,750
Ohio	70,000	1,060	74,200,000	11.5	8,533,000
Indiana	12,000	915	10,980,000	6.8	746,640
Illinois	1,075	820	881,500	7.0	61,705
Wisconsin	39,000	1,275	49,725,000	13.5	6,712,875
Missouri	1,498	730	1,093,540	9.0	98,419
Kentucky	290,000	870	252,300,000	7.7	19,427,100
Tennessee	43,400	785	34,069,000	7.5	2,555,175
Alabama	511	510	260,610	22.0	57,334
Mississippi	150	440	66,000	28.8	19,008
Louisiana	61	475	28,975	27.5	7,968
Texas	535	550	294,250	24.0	70,620
Arkansas	944	695	656,080	12.0	78,730
United States	796,099	857.2	682,428,530	10.0	68,232,647

Acreage, production, and value of tobacco in the United States, 1900–1906.

Year.	Acreage.	Average yield per acre.	Production.	Average farm price per pound Dec. 1.	Farm value Dec. 1.
	Acres.	*Pounds.*	*Pounds.*	*Cents.*	*Dollars.*
1900	1,046,427	778.0	814,345,341	6.6	53,661,132
1901	1,039,199	788.0	818,953,373	7.1	58,283,108
1902	1,030,734	797.3	821,823,963	7.0	57,563,510
1903	1,037,735	786.3	815,972,425	6.8	55,514,627
1904	806,409	819.0	660,460,739	8.1	53,382,959
1905	776,112	815.6	633,033,719	8.5	53,519,068
1906	796,099	857.2	682,428,530	10.0	68,232,647

International trade in unmanufactured tobacco, 1901-1905.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	11,212,917	7,609,206	8,349,919	7,524,375	4,959,479
Austria-Hungary	Jan. 1	17,601,923	20,846,465	18,967,908	21,628,003	18,687,919
Brazil	Jan. 1	73,791,238	99,473,274	51,585,095	52,882,124	[b] 44,953,473
British India	Apr. 1	30,701,163	23,999,513	23,375,964	25,000,133	26,299,275
Bulgaria	Jan. 1	2,397,108	4,087,076	3,763,682	1,328,732	5,749,096
Ceylon	Jan. 1	3,167,756	4,925,996	4,151,994	4,321,624	4,617,760
Cuba	Jan. 1	29,864,881	34,321,385	41,576,064	28,191,707	[c] 33,488,489
Dutch East Indies	Jan. 1	92,411,619	104,152,759	113,201,709	123,004,373	108,081,973
Greece	Jan. 1	9,408,706	10,461,326	12,776,805	9,689,636	[b] 12,765,055
Mexico	July 1	2,451,593	2,669,310	3,564,917	[b] 4,648,986	[b] 3,579,960
Netherlands	Jan. 1	4,864,567	4,786,081	4,751,225	4,855,896	3,834,794
Philippine Islands	Jan. 1	17,391,595	20,196,283	19,249,054	18,640,377	19,830,072
Russia	Jan. 1	12,712,061	7,257,324	11,205,599	12,810,474	[b] 15,889,632
Turkey [d]	Mar. 1	39,267,984	39,267,984	39,267,984	39,267,984	39,267,984
United States	July 1	301,007,365	368,184,084	311,971,831	334,302,091	312,227,202
Other countries		4,217,000	3,897,000	8,737,000	4,011,000	8,292,000
Total		652,469,446	756,165,796	676,459,758	692,052,515	662,505,163

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Argentina	Jan. 1	3,574,030	3,808,839	4,420,679	6,704,152	7,081,032
Australia	Jan. 1	5,951,230	5,544,080	5,158,793	6,629,793	5,371,534
Austria-Hungary	Jan. 1	48,697,895	47,650,259	51,576,911	51,898,125	50,850,488
Belgium	Jan. 1	20,194,983	19,424,226	20,982,344	24,053,526	22,141,627
British India	Apr. 1	4,838,835	3,666,148	4,963,937	4,181,826	6,701,073
Canada	July 1	11,329,674	13,380,504	14,248,303	13,859,152	14,519,458
Denmark	Jan. 1	9,475,465	9,442,396	9,900,957	10,210,707	9,744,429
Egypt	Jan. 1	13,997,116	14,806,955	15,016,414	17,043,686	17,612,999
Finland	Jan. 1	5,479,491	7,380,691	9,093,316	9,437,962	8,956,123
France	Jan. 1	58,438,116	48,619,010	56,402,809	57,368,125	66,966,964
Germany [e]	Jan. 1	134,362,451	133,982,375	137,778,884	143,445,274	178,956,160
Italy	Jan. 1	49,256,497	40,718,486	40,488,103	33,430,447	[b] 28,127,670
Netherlands	Jan. 1	45,795,081	47,201,281	52,690,827	50,279,873	42,252,451
Norway	Jan. 1	4,933,069	4,064,155	3,817,050	2,854,897	2,958,905
Portugal	Jan. 1	5,654,648	5,327,533	7,970,542	8,825,499	5,388,004
Spain	Jan. 1	50,870,200	42,488,042	42,999,521	55,741,625	[b] 42,999,521
Sweden	Jan. 1	8,390,417	8,579,174	8,585,455	11,714,014	7,221,852
United Kingdom	Jan. 1	79,481,331	119,459,941	78,424,398	102,227,367	79,819,143
United States	July 1	29,428,837	34,016,956	31,162,630	33,288,378	37,357,477
Other countries		41,214,000	49,228,000	53,185,000	54,436,000	41,479,000
Total		627,463,366	658,788,048	648,896,859	697,030,698	676,482,140

[a] See "General note," p. 546.
[b] Preliminary figures.
[c] Average, 1901-1904.
[d] Exports for 1900, latest available data.
[e] Not including free ports.

HOPS.

Hop crop of countries named, 1902-1906.

[Excluding Canada, for which the census of 1901 shows a production during the preceding year of 1,001,206 pounds. Other omitted countries are of very small production.]

Country.	1902.	1903.	1904.	1905.	1906.
NORTH AMERICA.					
United States: [a]	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New York	5,850,000	9,000,000	11,880,000	9,360,000	12,060,000
California	10,335,000	10,920,000	12,285,000	14,235,000	20,475,000
Oregon	16,965,000	17,550,000	17,550,000	22,191,000	23,985,000
Washington	5,850,000	6,825,000	7,410,000	9,750,000	8,775,000
Total United States	39,000,000	44,295,000	49,125,000	55,536,000	65,295,000

[a] Estimate based upon reports to California Fruit Grower and American Agriculturist.

Hop crop of countries named, 1902–1906—Continued.

Country.	1902.	1903.	1904.	1905.	1906.
EUROPE.					
Austria-Hungary:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria	19,829,000	9,010,000	19,598,000	39,305,000	[a] 17,100,000
Hungary	631,000	808,000	631,000	[b] 700,000	[a] 1,600,000
Total Austria-Hungary	20,460,000	9,818,000	20,229,000	40,005,000	[a] 18,700,000
Belgium	7,360,000	4,786,000	9,830,000	11,281,000	[a] 5,000,000
France	5,251,000	7,311,000	7,753,000	10,970,000	[a] 6,000,000
Germany	50,185,000	46,562,000	49,136,000	64,500,000	46,384,000
Netherlands	137,000	100,000	[a] 158,000	[b] 158,000	[b] 158,000
Russia	11,000,000	12,500,000	8,700,000	14,500,000	10,800,000
United Kingdom: England	34,837,000	47,160,000	31,621,000	77,946,000	27,517,000
Total Europe	129,230,000	128,237,000	127,427,000	219,360,000	114,559,000
OCEANIA.					
Australian Commonwealth:					
Victoria	252,000	176,000	274,000	162,000	[c] 216,000
Tasmania	651,000	809,000	865,000	912,000	[c] 809,000
New Zealand	930,000	940,000	1,150,000	1,120,000	[c] 1,035,000
Total Oceania	1,833,000	1,925,000	2,289,000	2,194,000	2,060,000
Grand total	170,063,000	174,457,000	178,841,000	277,090,000	181,914,000

[a] Estimate of Gütermann Sons, Saaz, Bohemia, Aug. 28, 1906.
[b] Average, 1900–1903.
[c] Average, 1902–1905.

International trade in hops, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	22,397,416	11,497,765	5,900,230	10,037,424	18,777,206
Belgium	Jan. 1	2,259,211	3,659,302	3,438,251	9,665,294	2,582,318
France	Jan. 1	230,650	541,964	442,521	784,610	606,364
Germany [b]	Jan. 1	14,528,459	22,702,756	22,003,671	24,358,207	22,855,096
Netherlands	Jan. 1	961,927	1,920,942	1,235,779	2,104,063	1,256,989
New Zealand	Jan. 1	481,376	482,832	433,776	644,336	[c] 369,712
Russia	Jan. 1	2,128,597	1,400,129	1,744,212	1,117,294	[c] 1,083,384
United Kingdom	Jan. 1	2,037,504	1,767,920	2,499,504	1,554,336	1,820,448
United States	July 1	10,715,151	7,794,705	10,985,988	14,858,612	13,026,904
Other countries		91,681	78,206	107,526	136,805	[c] 74,133
Total		55,831,972	51,846,521	48,791,458	65,260,981	62,452,554

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Australia	Jan. 1	1,230,459	1,140,388	975,658	913,830	1,279,362
Austria-Hungary	Jan. 1	608,476	1,025,811	4,481,556	2,109,162	1,187,189
Belgium	Jan. 1	3,814,620	4,427,816	6,478,233	4,826,301	6,617,221
British India	Apr. 1	460,208	495,824	517,328	469,728	448,224
Canada	July 1	789,598	623,403	781,822	737,054	1,020,265
Cape of Good Hope	Jan. 1	[d] 797,700	848,960	555,856	487,424	308,112
Denmark	Jan. 1	1,308,994	1,300,617	1,401,037	1,359,149	1,378,660
France	Jan. 1	4,779,155	4,312,256	5,045,432	4,428,343	3,879,328
Germany [b]	Jan. 1	15,390,025	6,004,068	2,992,995	5,346,208	9,047,989
Netherlands	Jan. 1	2,822,020	2,996,258	2,742,861	4,020,148	3,368,742
Russia	Jan. 1	872,016	945,289	807,085	1,363,547	1,191,722
Sweden	Jan. 1	1,536,240	1,461,343	1,436,809	1,298,174	1,662,563
Switzerland	Jan. 1	938,949	1,003,764	1,012,142	1,168,891	1,347,685
United Kingdom	Jan. 1	12,447,232	20,593,888	11,876,032	34,437,312	11,147,584
United States	July 1	2,805,293	6,012,510	2,758,163	4,339,379	10,113,989
Other countries		3,123,698	2,920,344	3,247,109	2,453,778	[c] 1,755,691
Total		53,724,683	56,112,539	47,110,118	69,758,428	55,754,326

[a] See "General note," p. 546. [b] Not including free ports. [c] Preliminary. [d] Estimated.

Wholesale prices of hops per pound in leading cities of the United States, 1902–1906.

Date.	New York.		Cincinnati.		Chicago.	
	Choice State.		Choice.		Pacific coast, common to choice.	
	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	14	16	14½	14½	12½	14
February	14½	18	15½	15½	15	16
March	17	19	17½	17½	13	16½
April	18	20	18½	18½	15	18
May	19	22	19½	19½	15	20
June	20½	24	21½	21½	15	20
July	22	26	23	23	20	22
August	24½	28	25	25	22	25
September	26	28	26½	26½	25	26
October	32	37	29½	29½	26	29
November	35	38	30	30	26	30
December	35	38	30	30	29	31
1903.					Good to choice.	
January	35	37	29	29	27	31
February	33	37	29	29	27	31
March	30	35	29½	29½	25	29
April	23	30	25	25	20	25
May	23	24	25	25	20	24
June	22½	24	24	24	22	24
July	20½	23½	24	24	19	22
August	20½	26	24	24	21	25
September	24½	30	25	25	26	28
October	30	33	26	26	20	27
November	30	32	26	26	24	26
December	30	35	27	27	24	27
1904.						
January	34	37	28	31	28½	34
February	36	38	31	34	30	35
March	34	38	30	32	32	34
April	33	36	30	32	30	34
May	33	35	29	31	30	35
June	32	35	29	30	30	32
July	32	34	29	30	30	31
August	32	35	29	29	30	34
September	33	37	29	31	28½	31
October	35	41	31	36	30	35½
November	36	41	36	37	32	37
December	35	38	34	36	33	37
1905.						
January	34	37	33	33	30	34
February	30	36	31½	31½	26	30
March	27	31	30	30	26	30
April	27	29	29	29	26	29
May	27	29	29	29	26	28
June	26	29	28	28	21	25
July	25	27	24	24	20	24
August	22	26	22	22	18	23
September	20	23	18½	18½	15	18
October	19	23	17	17	10	15
November	13	22	14½	14½	12	15
December	16	21	13½	13½	10	14
1906.						
January	15	19	13	14½	12	14
February	14	17	13	14½	10	14
March	13	16	12	14	9	14
April	12	15	12	17	10	17
May	11	15	12	15	9	15
June	11	14	12	15	9	14
July	12	17	12	17½	10	17
August	15	17	17	18	12	18
September	15	17	14	18	12	22
October	22	25	17	18	14	18
November	23	25	17½	18½	13	18
December	21	24	17½	18½	12	18

FLAXSEED.

Flax crop of countries named, 1903–1905.

[Substantially the crop of the world.]

Country.	Seed.			Fiber.		
	1903.	1904.	1905.	1903.	1904.	1905.
	Bushels.	*Bushels.*	*Bushels.*	*Pounds.*	*Pounds.*	*Pounds.*
NORTH AMERICA.						
United States	27,301,000	23,401,000	28,478,000			
Canada:						
Manitoba	605,000	479,000	337,000			
Saskatchewan	295,000	171,000	411,000			
Alberta	8,000	5,000	9,000			
Total Canada	908,000	655,000	757,000			
Mexico	49,000	188,000	150,000			
Total North America	28,258,000	24,244,000	29,385,000			
SOUTH AMERICA.						
Argentina	30,076,000	36,912,000	29,133,000			
Uruguay	8,176,000	5,530,000	6,000,000			
Total South America	38,252,000	42,442,000	35,133,000			
EUROPE.						
Austria-Hungary:						
Austria	1,120,000	1,162,000	1,370,000	103,848,000	105,850,000	123,127,000
Hungary proper	276,000	188,000	190,000	30,348,000	19,777,000	19,000,000
Croatia-Slavonia	44,000	27,000	29,000	13,205,000	9,214,000	9,000,000
Bosnia-Herzegovina	2,000	3,000	3,000	1,896,000	1,727,000	1,428,000
Total Austria-Hungary	1,442,000	1,380,000	1,592,000	149,297,000	136,568,000	152,555,000
Belgium	272,000	300,000	280,000	24,790,000	27,385,000	25,534,000
Bulgaria	350,000	36,000	2,000	[a] 20,000,000	[a] 2,000,000	173,000
France	544,000	608,000	575,000	43,537,000	52,445,000	45,515,000
Ireland				19,327,000	20,924,000	24,353,000
Italy [b]				41,917,000	41,917,000	41,917,000
Netherlands	362,000	459,000	437,000	18,497,000	22,348,000	18,440,000
Roumania	2,064,000	169,000	335,000	12,267,000	3,293,000	2,905,000
Russia:						
Russia proper	17,269,000	18,284,000	17,000,000	957,207,000	1,095,606,000	1,000,000,000
Poland	728,000	649,000	600,000	46,434,000	37,867,000	35,000,000
Northern Caucasia [c]	513,000	471,000	500,000	104,800,000	33,331,000	60,000,000
Total Russia (European)	18,510,000	19,404,000	18,100,000	1,108,441,000	1,166,804,000	1,095,000,000
Servia				1,032,000	1,200,000	905,000
Sweden [d]	39,000	37,000	37,000	2,241,000	2,070,000	2,000,000
Total Europe	23,583,000	22,393,000	21,358,000	1,441,396,000	1,476,963,000	1,409,297,000
ASIA.						
British India, including native States where reporting	19,263,000	22,873,000	13,896,000			
Russia:						
Central Asia	325,000	156,000	200,000	12,722,000	9,071,000	9,000,000
Siberia	709,000	630,000	600,000	38,265,000	33,111,000	35,000,000
Total Russia (Asiatic)	1,034,000	786,000	800,000	50,987,000	42,182,000	44,000,000
Total Asia	20,297,000	23,659,000	14,696,000	50,987,000	42,182,000	44,000,000
AFRICA.						
Algeria	65,000	36,000	35,000			
Grand total	110,455,000	112,774,000	100,607,000	1,492,383,000	1,519,145,000	1,453,297,000

[a] Estimated.
[b] Average 1892–1895.
[c] Includes government of Chernomorsk.
[d] Includes small quantity of hemp.

Acreage, production, and value of flaxseed in the United States in 1906, by States.

State or Territory.	Acreage.	Average yield per acre.	Production.	Average farm price, Dec. 1.	Farm value, Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
Wisconsin	39,000	14.0	546,000	104	567,840
Minnesota	431,048	11.0	4,741,528	103	4,883,774
Iowa	20,000	11.4	228,000	95	216,600
Missouri	35,894	7.3	262,026	93	243,684
North Dakota	1,465,745	9.9	14,510,876	102	14,801,094
South Dakota	379,000	10.5	3,979,500	100	3,979,500
Nebraska	16,590	8.5	141,015	95	133,964
Kansas	65,000	8.2	533,000	88	469,040
Indian Territory	6,284	8.0	50,272	95	47,758
Montana	24,855	12.0	298,260	100	298,260
Idaho	19,421	12.8	248,589	85	211,301
Oregon	2,048	12.0	24,576	125	30,720
California	1,042	12.0	12,504	125	15,630
United States	2,505,927	10.2	25,576,146	101.3	25,899,165

Wholesale prices of flaxseed per bushel in leading cities of the United States, 1902–1906.

Date.	St. Louis.		Cincinnati.		Chicago.		Milwaukee.		Duluth.	
	Prime.				No. 1.					
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.										
January	....	....	$1.30	$1.40	$1.58	$1.73	$1.61	$1.73	$1.56½	$1.71½
February	....	....	1.30	1.40	1.63	1.74	1.66	1.73	1.65	1.72
March	....	....	1.30	1.40	1.63	1.74	1.68	1.74	1.65	1.74
April	....	....	1.30	1.40	1.65	1.80	1.74	1.80	1.72	1.78
May	$1.50	$1.65	1.30	1.40	1.58	1.79	1.76	1.79	1.70	1.77
June	1.50	1.50	1.25	1.35	1.54	1.76	1.73	1.76	1.60	1.76½
July	1.41	1.50	1.30	1.40	1.36	1.74	1.43	1.74	1.35	1.66
August	1.32½	1.45	1.25	1.30	1.37	1.55	1.40	1.55	1.35	1.50
September	1.22	1.38	1.25	1.25	1.25½	1.46	1.25	1.45	1.21½	1.47
October	1.12	1.25	1.25	1.25	1.15	1.28	1.19	1.28	1.15¼	1.27¾
November	1.11	1.14½	1.25	1.25	1.13	1.23	1.18	1.23	1.15½	1.20
December	1.11	1.14	1.25	1.25	1.14	1.25	1.20	1.25	1.16	1.21½
1903.										
January	1.12	1.17	1.30	1.30	1.14	1.24	1.21	1.24	1.14½	1.20
February	1.10	1.14	1.30	1.30	1.12	1.22	1.16	1.22	1.11¾	1.16½
March	1.06	1.12	1.30	1.30	1.06	1.17	1.09	1.17	1.07¾	1.13½
April	1.03	1.08	1.10	1.30	1.06	1.12	1.09	1.11½	1.08¾	1.11
May	1.07	1.17	1.00	1.10	1.08	1.17½	1.11	1.17½	1.10¼	1.16
June	.95	1.08	1.00	1.00	.98	1.14	1.01½	1.14	.99½	1.13
July	.91	.96	1.00	1.00	.90	1.02½	.95½	1.02½	.95	1.00¾
August	.91	1.00	1.00	1.00	.93	1.05	.97	1.05	.96¾	1.01½
September	.92	1.00	1.00	1.00	.94	1.09	.99	1.09	.99	1.09
October	.88	.93	1.00	1.00	.89	1.03½	.94½	1.04	.92	1.02¾
November	.86	.89	1.00	1.00	.90	1.00	.94	1.00	.93½	1.00
December	.87½	.90½	1.00	1.00	.90½	1.02½	.97½	1.01½	.95⅝	1.00
1904.										
January	.92½	1.07	1.00	1.00	.97	1.19	1.03½	1.19	1.01½	1.17
February	1.06	1.08½	1.00	1.00	1.09	1.18½	1.16	1.18½	1.13½	1.17
March	1.04	1.06	1.00	1.00	1.07½	1.16½	1.13	1.16½	1.14	1.15½
April	.96	1.06	1.00	1.00	.98½	1.16	1.06	1.14½	1.05½	1.15⅝
May	.96	.98½	1.00	1.00	.99½	1.09½	1.06½	1.10	1.05⅞	1.08
June	.97	.98	1.00	1.00	1.00	1.08	1.06½	1.08½	1.07¾	1.09¾
July	.98	1.15½	1.00	1.00	1.02	1.24	1.07½	1.24	1.09¼	1.24
August	1.14½	1.18	....	....	1.15½	1.26½	1.23	1.26½	1.23	1.26½
September	1.08	1.18½	....	....	1.09	1.28	1.24½	1.28	1.16½	1.28
October	1.06	1.10	....	....	1.07	1.18	1.14½	1.18½	1.13½	1.17¼
November	1.07	1.11	....	....	1.08	1.19½	1.15½	1.19½	1.14	1.18⅝
December	1.12	1.16	....	....	1.11	1.26	1.19	1.26	1.18	1.25¾
1905.					(a)		(a)			
January	1.14	1.15	....	....	1.15	1.23	1.21	1.23	1.23	1.24
February	1.14	1.23	....	....	1.15	1.35	1.22	1.23½	1.24½	1.38½
March	1.22	1.26½	....	....	1.23	1.39½	1.35½	1.39½	1.35	1.40¾
April	1.22	1.26	....	....	1.23	1.40	1.37	1.40	1.39	1.42
May	1.22	1.29	....	....	1.25	1.47	1.39	1.47	1.40	1.48
June	1.24	1.29	....	....	1.25	1.47	1.43	1.47	1.47½	1.50
July	1.29	1.30	....	....	1.22½	1.44	1.34	1.44	1.48	1.48
August	1.04	1.30	....	....	1.01	1.35	1.12	1.35	1.30	1.48
September	.96	1.06	1.10	1.10	.92	1.12	.98	1.12	.97¼	1.30
October	.94	.97	1.10	1.10	.92	1.03	.98	1.03	.96¼	1.00
November	.94	.95	1.10	1.10	.93	1.00	.99	1.00	.98¼	1.00⅝
December	.95	1.10	1.10	1.10	.94	1.13	1.00	1.16	.98	1.16

a No. 1 Northwestern.

Wholesale prices of flaxseed per bushel in leading cities of the United States, 1902–1906—Continued.

Date.	St. Louis.		Cincinnati.		Chicago.		Milwaukee.		Duluth.	
	Prime.				No. 1 Northwestern.		No. 1 Northwestern.			
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1906.										
January	$1.06	$1.16	$1.10	....	$1.06	$1.25	$1.12½	$1.25	$1.11½	$1.24
February	1.06	1.11	1.10	....	1.06	1.16½	1.10	1.17	1.10¾	1.16¼
March	1.05	1.09	1.10	....	1.04½	1.14	1.11	1.14	1.10⅜	1.17¼
April	1.08	1.11	1.10	$1.12	1.06	1.16½	1.12	1.18	1.14¼	1.20
May	1.05	1.08	1.12	....	1.06½	1.17	1.12½	1.15¾	1.12½	1.18
June	1.05	1.06½	1.12	....	1.07	1.13	1.11	1.13½	1.11¾	1.14⅞
July	1.03	1.07	1.12	....	1.05	1.12½	1.05	1.12½	1.11¼	1.14¾
August	1.02	1.05	1.12	....	1.05½	1.14	1.10	1.14	1.12	1.17¾
September	.98	1.02½	1.12	....	1.03	1.13	1.08	1.14½	1.09¼	1.17½
October	1.03	1.07	1.12	....	1.04½	1.15	1.09½	1.13¼	1.11⅛	1.15⅝
November	1.08	1.17	1.12	....	1.07½	1.22	1.13	1.20½	1.14⅞	1.25⅝
December	1.15	1.19	1.12	....	111.½	1.23½	1.17½	1.22	1.18⅜	1.22⅛

RICE.

Rice crop of countries named, 1901–1905.

[Mostly cleaned rice. China, which is omitted, has a roughly-estimated crop of 50,000,000,000 to 60,000,000,000 pounds. Other omitted countries are Afghanistan, Algeria, Brazil, Colombia, Federated Malay States, Madagascar, Persia, Russia (Asiatic), Trinidad and Tobago, Turkey (Asiatic and European), Venezuela, and a few other countries of small production.]

Country.	1901.	1902.	1903.	1904.	1905.
NORTH AMERICA.					
United States:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Contiguous	[a] 388,000,000	[a] 319,400,000	[a] 560,800,000	586,000,000	378,000,000
Noncontiguous—Hawaii	[b] 33,400,000	[b] 33,400,000	[b] 33,400,000	[b] 33,400,000	[b] 33,400,000
Total United States (except Philippine Islands)	421,400,000	352,800,000	594,200,000	619,400,000	411,400,000
Central America:					
Guatemala	300,000	700,000	1,000,000	1,300,000	[c] 1,300,000
Honduras	8,100,000	[d] 8,100,000	[d] 8,100,000	[d] 8,100,000	[d] 8,100,000
Mexico	41,800,000	40,000,000	48,700,000	62,000,000	[c] 62,000,000
Total North America	471,600,000	401,600,000	652,000,000	690,800,000	482,800,000
SOUTH AMERICA.					
Argentina	[e] 2,000,000	[e] 2,000,000	[e] 2,000,000	[e] 2,000,000	[e] 2,000,000
British Guiana	29,300,000	22,800,000	24,500,000	31,200,000	32,800,000
Dutch Guiana	800,000	800,000	1,000,000	1,900,000	[c] 1,900,000
Peru	60,000,000	60,000,000	60,000,000	60,000,000	60,000,000
Total South America	92,100,000	85,600,000	87,500,000	95,100,000	96,700,000
EUROPE.					
Austria	600,000	700,000	600,000	700,000	800,000
Bulgaria	[f] 9,900,000	[f] 9,900,000	9,800,000	12,200,000	10,800,000
Italy	670,300,000	668,400,000	761,400,000	760,500,000	676,600,000
Spain	382,900,000	359,800,000	417,100,000	394,600,000	478,600,000
Total Europe	1,063,400,000	1,038,800,000	1,188,900,000	1,168,000,000	1,166,800,000
ASIA.					
British India: [g]					
British Provinces	62,153,000,000	72,688,000,000	68,580,000,000	71,561,000,000	69,927,000,000
Native States	[h] 711,000,000	[h] 799,000,000	[h] 838,000,000	[h] 764,000,000	[c] 764,000,000
Total British India	62,864,000,000	73,487,000,000	69,418,000,000	72,325,000,000	70,691,000,000

[a] Commercial movement.
[b] Census 1899.
[c] Figures for previous year used.
[d] 1901 figures used.
[e] Unofficial estimate.
[f] 1899 figures used.
[g] Figures for British India refer to crop years beginning in the spring of the calendar years mentioned in this table.
[h] Estimated from official returns for acreage.

Rice crop of countries named, 1901–1905.—Continued.

Country.	1901.	1902.	1903.	1904.	1905.
ASIA—continued.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Ceylon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
French Indo-China	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Japanese Empire:					
Japan	[illegible]	[illegible]	[illegible]	[illegible]	11,940,000,000
Formosa	1,914,800,000	[illegible]	[illegible]	[illegible]	b2,598,100,000
Total Japanese Empire	16,565,200,000	[illegible]	[illegible]	[illegible]	14,538,100,000
Java and Madura	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Korea	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Philippine Islands	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Siam	[illegible]	[illegible]	[illegible]	[illegible]	c 3,300,000,000
Straits Settlements	[illegible]	[illegible]	95,000,000	[illegible]	[illegible]
Total Asia	97,794,300,000	[illegible]	[illegible]	[illegible]	[illegible]
AFRICA.					
British Central Africa	f 2,200,000	[illegible]	[illegible]	[illegible]	[illegible]
Egypt	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Africa	22,200,000	22,200,000	22,200,000	[illegible]	[illegible]
OCEANIA.					
Fiji	c 1,900,000	c 3,500,000	c 3,000,000	c 3,000,000	[illegible]
Queensland	100,000	(g)	(g)	(g)	(g)
Total Oceania	2,000,000	3,500,000	3,000,000	3,000,000	3,000,000
Grand total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

a Estimated from official returns for acreage.
b Figures for previous year used.
c Unofficial estimate.
d Estimated from official returns of exports of this country, and from per capita consumption of rice in Japan, including food, seed and waste but not including rice used for sake, for 1894–1903 ([illegible] pounds per annum).
e Census, [illegible].
f 1904 figures used.
g Less than 50,000 pounds.

Acreage, production, and value of rice in the United States in [illegible], by States.

State.	Acreage.	Average yield per acre.	Production.	Average farm price Dec. 1.	Farm value Dec. 1.
	Acres.	*Bushels.*	*Bushels.*	*Cents.*	*Dollars.*
North Carolina	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
South Carolina	[illegible]	22.0	[illegible]	[illegible]	[illegible]
Georgia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Florida	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Alabama	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mississippi	[illegible]	20.0	[illegible]	[illegible]	[illegible]
Louisiana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Texas	[illegible]	36.0	[illegible]	[illegible]	[illegible]
Arkansas	[illegible]	31.0	[illegible]	[illegible]	[illegible]
United States	575,014	31.1	[illegible]	[illegible]	[illegible]

Wholesale prices of rice per pound, 1902–1906.

Date.	New York.		Cincinnati.		Lake Charles.		New Orleans.		Houston.	
	Domestic (good).		Prime.		Rough.[a]		Honduras, cleaned.		(Head rice.) cleaned.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	4¾	4¾	5½	6½	1.75	3.00	2⅛	5⅞	3½	5¼
February	4¾	4¾	5½	6½	1.75	3.00	2	6	3¾	5¼
March	4¾	4¾	5½	6½	......	......	2	6	4	5½
April	4¾	4¾	5½	6½	......	......	2	5¾	4	5½
May	4¾	5	5½	6½	......	......	2	5¾	4	5½
June	4⅞	5¼	5½	6½	......	......	1½	6	4	5½
July	4⅞	5¼	5½	6½	......	......	1⅜	6½	4	5½
August	4⅞	4⅞	5½	6½	......	......	1⅝	5⅞	4	5½
September	4 15/16	4 15/16	5½	6½	2.00	3.40	1¾	5¾	4½	5¾
October	4 15/16	4 15/16	5¼	5¾	1.90	3.25	1½	5⅞	4½	5¾
November	4 15/16	4 15/16	5¼	5¾	2.00	3.20	1⅜	6 3/16	4½	5¾
December	5	5	5¼	5¾	1.75	3.30	1⅜	6¼	4½	5¾
1903.										
January	4⅞	5	4⅜	5¼	1.75	3.40	1¼	6½	4½	5⅞
February	5	5	4⅜	5¼	1.75	3.40	1¾	6¼	4½	6
March	5⅛	5¼	4⅜	5¼	1.75	3.40	1¾	6⅜	4½	6
April	5¼	5¼	4⅜	5¼	......	......	1⅞	6½	4½	5¾
May	5¼	5¼	4⅜	5¼	......	......	2⅛	6⅛	4½	5¾
June	5¼	5¼	4⅜	5¼	......	......	2¼	6⅛	4½	6
July	5¼	5¼	4⅜	5¼	......	......	2½	6⅛	4¾	6⅛
August	5⅛	5¼	4⅜	5¼	......	......	2¼	6	4¾	6⅛
September	4⅞	5⅛	4⅜	5¼	2.00	3.60	2⅜	5⅝	4¾	6¼
October	4¾	4⅞	4⅜	5½	1.75	3.60	1⅝	5⅝	4¾	6¼
November	4¼	4½	4⅝	5½	1.60	3.25	1⅛	5½	4¼	5½
December	4¼	4¼	4⅝	5½	1.50	3.00	1¼	5	4	5
1904.										
January	4¼	4¼	4¾	5¼	1.50	3.00	1½	4⅞	3½	4¾
February	4	4	4¾	5¼	1.50	2.75	1½	4⅝	3½	4⅝
March	4	4	4½	5	1.25	2.50	1½	4¾	3½	4½
April	4	4	4¼	4¾	1.25	2.25	1⅛	4¼	3¼	4¼
May	3¾	4	4¼	4¾	1.25	2.00	1⅜	4⅜	3¼	4
June	3⅝	3¾	4¼	4¾	1.25	2.00	1 7/16	4	3¼	4
July	3⅝	3⅝	3¾	4¼	1.25	2.00	1⅝	4¼	3	4
August	3⅜	3⅝	3¾	4¼	1.25	2.00	1⅝	5¼	3	4
September	3⅜	3⅜	3¾	4¼	1.25	2.00	1¼	4¾	3	4
October	3⅜	3⅜	3¾	4¼	1.10	2.00	1¼	5	3	3⅞
November	3⅜	3⅜	3¾	4¼	1.10	2.00	1⅛	5⅛	3	3¾
December	3⅜	3⅜	3¾	4¼	1.00	2.00	1 1/16	5¼	3	3¾
1905.										
January	3⅜	3⅜	3¾	4¼	1.00	2.00	1⅛	5⅛	3	3¾
February	3⅜	3⅜	3¾	4¼	1.00	2.00	1	4¾	3	3¾
March	3⅜	3⅜	3	4	1.00	2.35	1 3/16	4⅝	3	3¾
April	3⅜	3⅜	3	4	1.00	2.25	1⅛	4⅛	3	3½
May	3⅜	3⅜	3½	4½	1.00	2.50	1⅜	4½	3	3½
June	3½	3¾	4	5	1.00	2.50	2⅛	5	3	3¾
July	3¾	3¾	4	5	1.00	2.50	2⅛	4¾	3	4
August	3¾	3¾	4	5	1.25	3.00	1¾	5¼	3	4¼
September	3¾	4	4	5	2.00	3.25	1¾	5⅝	3	4½
October	4½	4½	4	5	2.00	3.25	2	5¾	3	4¾
November	4½	4½	4½	5¼	2.00	3.75	2⅜	5⅜	3	5
December	4½	4½	4½	5¼	2.00	3.85	2	5½	3½	5
1906.										
January	5	5¼	4½	5¼	2.25	3.85	2⅝	5⅜	4	5½
February	5	5¼	4½	5¼	2.25	3.85	2⅜	5½	4	5½
March	5	5	4½	5¼	2.25	3.85	2	5½	4	5½
April	4⅞	5	4½	5½	......	......	2⅛	5¾	3½	5
May	4⅞	5	4¾	5¼	......	......	1⅞	6	3½	5
June	5	5¼	4¾	5½	......	......	2⅛	5¾	3¾	5¼
July	5¼	5½	4¾	5½	......	......	2⅛	5¾	3¾	5¼
August	5¼	5¼	4¾	5½	2.50	3.85	2	6½	3¾	5¼
September	5¼	5¼	4¾	5½	2.50	3.85	2⅜	5⅝	3¾	5¼
October	5⅜	5½	4¾	5½	2.25	3.85	2⅛	5¾	4¼	5¾
November	5¼	5⅝	4¾	5½	2.25	3.50	2	5⅝	4½	5¾
December	5	5¼	4¾	5½	2.00	3.25	1¾	5¾	4	5¼

[a] Per barrel of 162 pounds.

International trade in rice, 1901–1906. [a]

[Mostly cleaned rice.]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Belgium	Jan. 1	37.833.573	40.836.811	51.066.830	62.594.036	43.764,979
British India	Apr. 1	3.820.729.248	5.331.694.928	5.054.477.904	5.546.790.144	4.839.327,360
Dutch East Indies	Jan. 1	85.186.473	96.676.723	85.391.653	105.792.310	98.682,964
Formosa	Jan. 1	84.073.252	135.506.436	184.676.337	197.154.447	221.566 374
France	Jan. 1	103.883.995	55.255.538	58.770.569	52.021.579	54,091,776
French Indo-China	Jan. 1	2.014.099.206	2.459.480.061	1.490.364.515	2.128.799.044	1.371.356.455
Germany [b]	Jan. 1	212.871.686	227.755.531	227.666.173	181.073.702	222.773.526
Netherlands	Jan. 1	197.376.644	246.932.274	256.578.864	298.075.104	282.611,808
Penang	Jan. 1	228.693.333	315.152.667	229.739.333	154.148.400	[c] 231.933.433
Siam	Jan. 1	1,534,231,467	1.785.261.733	1.310.950,400	1.892.988.933	1,838.736.800
Singapore	Jan. 1	786.173.600	819.742.133	687.836.400	702.571.733	[c] 749.089.966
Other countries		563.477.000	521,922.000	587.795.000	585.125.000	262.615.000
Total		9.668.609.537	12.034.191.615	10,225.308.978	11,907,134,492	10.216,541,441

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Austria-Hungary	Jan. 1	165.785.811	171.421.706	162.532.230	189.403.926	234.525.043
Belgium	Jan. 1	142.662.657	154.653.404	164.558.287	166.709.664	168.801.762
Brazil	Jan. 1	197.038.775	222.632.829	162.255.816	134.043.452	[d] 129.413.516
British India	Apr. 1	302.487,248	339.482.752	381.130.672	377.021.680	401.312.992
Ceylon	Jan. 1	654.883.336	641.730,096	687.646.128	699.259.008	745.446,016
China	Jan. 1	588.214.533	1.297.420.533	373.585.867	447.577.333	297,055,467
Cuba	Jan. 1	195.053.948	169.841.863	149.574.339	198.439.462	[c] 177.727,403
Dutch East Indies	Jan. 1	1.339.493.984	819.659.758	440,099,790	678.382,754	661.764.477
Egypt	Jan. 1	97,567.921	89.927.955	84.159.745	104.163.198	89.979,896
France	Jan. 1	286.667.938	445.326.924	236,359,026	466.328.330	414.854.789
Germany [b]	Jan. 1	569.902.028	806.702.495	642.295.455	602.833,603	627.278,011
Japan	Jan. 1	414.925.067	601.202.600	1.621.654.000	1,964.238.000	1,546,121,733
Mauritius	Jan. 1	142.291.685	138.228.382	141.143,562	159.853.482	114.012,080
Netherlands	Jan. 1	411,543.370	495.572,167	495.788.900	523,497.732	493.955,916
Penang	Jan. 1	176.852.267	162.545.333	153.461,067	252,778.533	[c] 184,859,300
Philippine Islands	Jan. 1	376.211.389	639.496.077	737.083.174	585.880.567	483.411.974
Russia	Jan. 1	150.543.174	138.455.658	162.207.811	157,232,062	[d] 160.521.396
Singapore	Jan. 1	1.019,341.867	1.040.446.667	849.067.467	900.587.900	[c] 952.360.900
United Kingdom	Jan. 1	474.888.176	762.437.536	607.701.584	629.591,664	685.939.744
United States	July 1	157.658.894	169.656.284	154.221.772	106.483.515	166.547.957
Other countries		925.445.000	970.693.000	1.074.569.000	1.206.744.000	624.916,000
Total		8.789.519.068	10.277,303.017	9.480.935.752	10.540.049.565	9.420.806.372

[a] See "General note," p. 546.
[b] Not including free ports.
[c] Average 1901–1904.
[d] Preliminary figures.

SUGAR.

Sugar production of countries named, 1902–3 to 1906–7.

[European beet sugar, as estimated by Licht; United States beet sugar, from reports of Department of Agriculture on the Progress of the Beet-Sugar Industry in the United States; production of British India, from official statistics; other data, from Willett & Gray. The estimates of Willett & Gray do not include the production of China, Formosa, Natal, and some other less important sugar-producing countries.]

Country.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
CANE SUGAR.					
NORTH AMERICA.					
United States:					
Contiguous—	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]	*Tons.* [a]
Louisiana	329,226	215,000	335,000	330,000	230,000
Texas	([b])	19,800	15,000	12,000	13,000
Noncontiguous—					
Hawaii	391,062	328,103	380,576	383,225	390,000
Porto Rico	85,000	130,000	145,000	213,000	255,000
Total United States (except Philippine Islands)	805,288	692,903	875,576	938,225	888,000
Central America:					
Guatemala	8,000	7,640	7,640	6,795	7,000
Salvador	6,000	6,300	5,588	5,944	6,000
Nicaragua	4,500	4,235	4,235	4,400	4,000
Costa Rica	3,000	3,275	2,305	1,377	2,000
Mexico	112,679	107,547	107,038	107,529	115,000
West Indies:					
British—					
Antigua and St. Kitts	18,000	19,000	24,000	24,000	24,000
Barbados	38,179	58,081	41,600	49,864	40,000
Jamaica	18,772	14,255	11,251	12,523	15,000
Trinidad	42,679	44,058	31,000	55,000	50,000
Cuba	998,878	1,040,228	1,163,258	1,178,749	1,250,000
Danish—St. Croix	13,000	13,000	11,000	13,000	13,000
French—					
Guadeloupe	38,498	35,976	36,000	36,000	36,000
Martinique	29,035	23,936	29,986	42,231	40,000
Haiti and Santo Domingo	50,000	47,000	47,000	55,000	60,000
Lesser Antilles	12,000	13,000	13,000	13,000	13,000
Total North America	2,198,508	2,130,434	2,410,477	2,543,637	2,563,000
SOUTH AMERICA.					
Argentina	130,000	142,895	128,104	137,308	120,000
Brazil	187,500	197,000	195,000	275,000	260,000
British Guiana	121,570	113,282	101,278	121,693	118,000
Dutch Guiana	13,046	13,000	13,000	13,000	13,000
Peru	123,906	131,957	150,000	150,000	140,000
Venezuela	3,000	3,000	3,000	3,000	3,000
Total South America	579,022	601,134	590,382	700,001	654,000
EUROPE.					
Spain	28,000	28,000	18,592	14,512	15,000
ASIA.					
British India [c]	1,906,784	1,871,986	2,169,000	1,725,300	2,223,400
Java	842,812	885,561	1,008,900	990,994	1,011,546
Philippine Islands	90,000	84,000	106,875	145,525	150,500
Total Asia	2,839,596	2,841,547	3,284,775	2,861,819	3,385,446

[a] Tons of 2,240 pounds, except beet sugar in Europe, which is in metric tons of 2,204.622 pounds.
[b] Not estimated.
[c] Official estimates for such parts of British India as return statistics of production.

Sugar production of countries named, 1902–3 to 1906–7—Continued.

Country.	1902–3.	1903–4.	1904–5.	1905–6.	1906–7.
AFRICA.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Egypt	87,500	60,000	60,000	65,000	60,000
Mauritius	150,349	220,589	142,101	188,364	205,000
Reunion	39,624	41,117	30,000	30,000	30,000
Total Africa	277,473	321,706	232,101	283,364	295,000
OCEANIA.					
Australian Commonwealth:					
Queensland	76,626	91,828	147,688	170,000	182,000
New South Wales	21,000	21,500	21,525	20,000	24,000
Fiji	35,500	50,000	47,000	40,000	43,000
Total Oceania	133,126	163,328	216,213	230,000	249,000
Total cane-sugar production	6,055,725	6,086,149	6,752,540	6,633,333	7,161,446
BEET SUGAR.					
NORTH AMERICA.					
United States	194,782	214,825	216,173	279,393	431,796
Canada	6,696	6,710	8,034	11,419	11,367
Total North America	201,478	221,535	224,207	290,812	443,163
EUROPE.					
Austria-Hungary	1,057,692	1,167,959	889,373	1,509,870	1,335,000
Belgium	224,090	209,811	176,466	328,770	280,000
France	833,210	804,308	622,422	1,089,684	755,000
Germany	1,762,461	1,927,681	1,598,164	2,415,136	2,250,000
Netherlands	102,411	123,551	136,551	207,189	190,000
Russia	1,256,311	1,206,907	953,626	968,000	1,450,000
Other countries	325,082	441,116	332,098	415,000	440,000
Total Europe	5,561,257	5,881,333	4,708,700	6,933,649	6,700,000
Total beet-sugar production	5,762,735	6,102,868	4,932,907	7,224,461	7,143,163
Total cane and beet sugar	11,818,460	12,189,017	11,685,447	13,857,794	14,304,609

Quantity and value of sugar imported into the United States from the principal sources of supply, 1902–1906.

QUANTITY.

Country from which imported.	Imports for year ending June 30—				
	1902.	1903.	1904.	1905.	1906.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	111,818,771	40,857,724	3,525,512	2,764,206	1,676,257
Belgium	479,655			20,820,667	784,000
Brazil	349,794,460	74,159,889	14,186,540	49,968,032	28,877,781
British Guiana	181,237,759	172,361,345	73,295,689	56,015,487	50,930,124
British West Indies	194,969,474	191,924,220	65,850,114	80,553,082	37,367,355
Canada	2,436,647	6,285,045	4,034,551	2,153,019	51,246,131
Chinese Empire	2,397,107	752,285	4,602,045	8,351,757	785,422
Cuba	984,216,925	2,396,497,779	2,819,558,402	2,057,684,169	2,781,901,380
Danish West Indies	16,037,682	41,205,950	20,837,461	12,851,640	17,233,750
Dutch East Indies	636,710,315	891,758,090	440,370,139	899,394,575	781,891,724
Dutch Guiana	16,861,587	15,722,225	6,994,546	11,407,700	2,427,536
Egypt	59,557,384	62,348,580	22,222,552	2,596,236	
Germany	217,872,627	91,745,860	5,480,349	205,084,302	12,480,459
Mexico	338,368	2,414,373	1,250,252	24,049,489	3,540,984
Netherlands	8,967,942	200,000			
Peru	102,647,624	88,848,044	48,671,777	47,789,588	36,371,943
Philippine Islands	11,424,000	18,773,333	61,570,614	77,997,424	69,373,602
Santo Domingo	111,580,425	112,988,775	95,790,189	109,111,269	96,845,109
United Kingdom	11,125,336	119,739	70	1,541,724	2,880,490
Other countries	11,241,787	7,144,850	12,382,811	10,798,632	2,717,383
Total	3,031,915,875	4,216,108,106	3,700,623,613	3,680,932,998	3,979,331,430

VALUE.

Country from which imported.	1902.	1903.	1904.	1905.	1906.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Austria-Hungary	2,288,547	677,836	80,393	79,403	44,606
Belgium	11,607			473,749	19,672
Brazil	4,908,735	1,176,049	200,102	1,266,275	398,153
British Guiana	3,372,104	3,333,032	1,428,433	1,460,969	988,730
British West Indies	3,226,575	3,136,172	1,092,663	1,626,078	641,489
Canada	123,441	256,894	196,633	146,644	149,809
Chinese Empire	63,429	13,640	123,900	227,260	19,849
Cuba	18,205,411	42,714,079	56,547,403	64,366,104	60,208,148
Danish West Indies	377,581	705,587	396,384	382,861	345,972
Dutch East Indies	12,325,518	13,251,816	7,409,996	15,611,568	16,941,593
Dutch Guiana	349,242	301,235	134,902	317,837	293,629
Egypt	1,351,038	1,014,831	415,551	57,190	
Germany	3,597,234	1,370,305	117,410	4,403,237	1,100,567
Mexico	9,408	103,439	35,998	933,284	121,926
Netherlands	232,963	4,888			
Peru	1,910,311	1,517,514	860,605	1,018,208	757,356
Philippine Islands	188,159	270,729	884,160	1,498,399	1,424,167
Santo Domingo	2,061,977	2,107,428	1,750,145	3,490,933	1,871,608
United Kingdom	192,945	2,241	4	41,724	62,974
Other countries	264,872	131,258	241,071	243,726	69,840
Total	55,061,097	72,088,973	71,915,753	97,645,449	85,460,088

International trade in sugar 1901–1905.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	1,544,328,467	1,508,882,186	1,564,437,691	1,123,102,823	1,265,587,951
Argentina	Jan. 1	108,957,887	91,919,510	66,588,231	49,366,863	4,847,964
Belgium	Jan. 1	514,255,840	298,287,771	257,186,695	408,944,665	304,193,652
Brazil	Jan. 1	411,638,577	361,498,062	48,256,967	17,331,526	[b] 83,216,786
British Guiana	Apr. 1	269,984,480	280,284,480	282,125,760	239,640,840	269,606,400
British India	Apr. 1	51,417,856	55,645,520	57,474,592	57,211,504	64,546,944
China	Jan. 1	116,759,733	89,945,867	39,890,000	48,787,467	55,894,800
Cuba	Jan. 1	1,319,798,470	1,781,561,643	2,118,279,646	2,459,166,945	[d] 1,919,701,176
Dutch East Indies	Jan. 1	1,595,413,951	1,964,371,591	1,907,867,945	2,318,245,282	[b] 2,315,723,926
Egypt	Jan. 1	108,709,976	98,521,149	86,469,803	50,627,531	67,821,136
Formosa	Jan. 1	80,758,599	100,873,254	54,128,545	79,518,816	93,931,629
France	Jan. 1	1,446,958,265	804,993,320	469,129,814	630,306,461	637,313,530
Germany [c]	Jan. 1	2,399,611,997	2,367,598,256	2,249,141,054	1,720,574,091	1,636,803,746
Mauritius	Jan. 1	345,999,192	331,172,713	375,505,649	455,825,559	[b] 361,988,928
Netherlands	Jan. 1	342,808,840	330,094,069	287,238,939	405,471,558	213,047,853
Peru	Jan. 1	251,230,174	258,738,790	281,482,880	290,925,960	297,955,805
Philippine Islands	Jan. 1	125,799,930	217,486,869	188,114,307	191,917,567	239,196,273
Reunion Island	Jan. 1	91,493,166	50,677,330	107,802,584	80,432,029	[d] 82,406,262
Russia	Jan. 1	282,752,715	288,610,854	540,418,988	398,854,898	[b] 221,154,787
Trinidad and Tobago	Apr. 1	100,342,968	105,861,392	90,466,944	108,573,936	[b] 81,179,056
United Kingdom	Jan. 1	61,308,608	89,136,232	115,269,728	65,908,756	72,508,128
Other countries		492,073,000	617,792,000	609,680,000	569,646,000	320,347,000
Total		12,072,564,710	11,935,007,938	11,797,304,142	11,742,935,027	10,607,013,753

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Australia	Jan. 1	229,738,896	208,551,056	205,026,640	85,198,624	55,851,040
British India	Apr. 1	617,563,424	549,868,704	672,147,168	724,292,224	841,857,744
Canada	July 1	378,675,447	388,371,832	390,544,660	348,752,590	449,014,520
Cape of Good Hope	Jan. 1	95,304,081	120,301,406	104,629,648	101,466,941	82,805,094
Chile	Jan. 1	82,274,551	97,992,936	117,467,959	124,139,619	74,345,795
Denmark	Jan. 1	66,779,702	42,451,621	77,374,516	82,865,127	76,080,072
Egypt	Jan. 1	16,567,852	22,844,441	16,920,999	45,845,510	86,880,895
Finland	Jan. 1	61,933,644	61,752,745	72,691,465	71,263,531	73,772,007
France	Jan. 1	222,415,841	220,187,363	288,073,883	179,849,557	179,458,147
Italy	Jan. 1	84,766,441	47,355,501	14,477,532	4,928,873	[b] 11,251,729
Japan	Jan. 1	667,079,667	551,750,583	523,131,067	547,300,400	289,129,733
Netherlands	Jan. 1	197,258,665	248,799,655	205,061,092	216,708,915	156,162,492
New Zealand	Jan. 1	79,308,066	84,878,674	88,197,686	91,841,944	[b] 89,439,230
Norway	Jan. 1	81,357,913	82,791,956	83,524,155	76,703,054	77,995,596
Persia	Mar. 21	[e] 167,114,080	[e] 167,114,080	179,411,238	154,817,921	[e] 167,114,080
Portugal	Jan. 1	62,211,615	68,631,016	68,763,610	72,496,231	70,011,389
Singapore	Jan. 1	95,558,467	98,271,733	102,309,867	114,407,600	[d] 101,402,167
Switzerland	Jan. 1	159,432,311	180,271,163	192,015,742	175,444,701	192,011,994
Turkey [f]	Jan. 1	273,612,826	273,612,826	273,612,826	273,612,826	273,612,826
United Kingdom	Jan. 1	3,858,474,048	3,522,549,520	3,487,111,376	3,602,455,248	3,272,097,024
United States	July 1	3,082,915,875	4,216,108,106	3,700,623,613	3,680,932,998	3,979,331,430
Uruguay	July 1	41,221,991	43,295,200	39,934,265	49,899,414	[d] 43,572,720
Other countries		591,358,000	920,497,000	797,274,000	893,821,000	834,851,000
Total		11,139,148,803	12,006,861,475	11,696,386,507	11,711,004,845	11,478,046,724

[a] See "General note," p. 546.
[b] Preliminary figures.
[c] Not including free ports.
[d] Average, 1901–1904.
[e] Average, 1900–1904.
[f] Imports for 1899, latest available returns.

Production of sugar in the United States and possessions, 1854–5 to 1906–7.

[Census data, as far as available, are given in *italics*. Beet-sugar production for 1897–98 from Special Report of Department of Agriculture; for 1901–2 to 1906–7 from Progress of the Beet-Sugar Industry in the United States; for other years from Willett & Gray. Production of cane sugar in Louisiana for 1904–5 to 1906–7, and of Texas for 1903–4 to 1906–7, from Willett & Gray; earlier statistics for Louisiana and other Southern States from Bouchereau, in part taken directly from his reports and in part from the Statistical Abstract. Porto Rican production of cane sugar for 1854–55 to 1884–85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Hawaii, 1874–75 to 1880–81, represent exports, from Bureau of Statistics Bul. 30; for 1881–82 to 1884–85 from Rueb & Co.; for later years from Willett & Gray. Statistics for Philippine Islands for 1854–55 to 1857–58, 1859–60 to 1866–67, 1872–73 to 1894–95 represent exports as officially returned, taken from the Census of the Philippine Islands, 1903; for 1858–59, 1867–68 to 1871–72 from Foreign Markets Bul. 14, representing commercial estimates of exports; for later years from Willett & Gray, the statistics for 1895–96 to 1903–4 representing exports, for 1904–5 to 1906–7, production. Tons of 2,240 pounds are used throughout.]

Year.	Beet sugar.	Cane sugar.					Total.
		Louisiana.	Other Southern States.	Porto Rico.	Hawaii.	Philippine Islands.	
	Long tons.	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
1854–55	....	171,976	13,169	58,377	....	35,008	278,530
1855–56	....	113,647	9,821	82,000	....	47,397	252,865
1856–57	....	36,327	2,673	85,000	....	36,066	160,066
1857–58	....	137,351	6,385	69,444	....	26,858	240,038
1858–59	....	185,177	8,169	58,000	....	50,095	301,441
1859–60	....	113,891	5,149	57,000	....	49,013	225,053
1860–61	....	118,332	4,313	67,000	....	45,316	234,961
1861–62	....	235,858	5,138	68,000	....	60,957	369,953
1862–63	....	43,232	2,768	63,000	....	51,240	160,240
1863–64		37,723	250	61,590	....	44,325	144,288
1864–65		4,821	179	63,375	....	46,092	114,867
1865–66		8,884	348	64,417	....	40,636	114,685
1866–67		19,152	3,348	68,229	....	55,195	146,324
1867–68	a 400	18,482	4,518	73,935	....	74,081	171,416
1868–69		42,434	2,567	81,500	....	68,818	195,719
1869–70		44,399	2,402	102,110	....	78,214	227,525
1870–71		75,392	4,208	103,304	....	87,465	270,769
1871–72		65,583	4,217	89,559	....	95,526	255,285
1872–73	500	55,958	4,235	87,639	....	83,865	232,197
1873–74	700	46,090	2,410	71,755	....	99,770	220,725
1874–75		60,047	3,454	72,128	11,197	126,089	273,015
1875–76	b 100	72,954	4,046	70,016	11,639	128,485	287,240
1876–77		85,122	3,879	62,340	11,418	121,052	283,911
1877–78		65,071	5,330	84,347	17,157	120,096	292,701
1878–79	200	106,908	5,090	76,411	21,884	129,777	340,270
1879–80	1,200	88,822	3,980	57,057	28,386	178,329	357,774
1880–81	500	121,867	5,500	61,715	41,870	205,508	436,960
1881–82	b 500	71,373	5,000	80,066	50,972	148,047	355,958
1882–83		135,297	7,000	77,632	51,705	193,726	465,860
1883–84	535	128,443	6,800	98,665	63,948	120,199	418,590
1884–85	953	94,376	6,500	70,000	76,496	200,997	449,322
1885–86	600	127,958	7,200	64,000	96,500	182,019	478,277
1886–87	800	80,859	4,535	86,000	95,000	169,040	436,234
1887–88	255	157,971	9,843	60,000	100,000	158,445	486,514
1888–89	1,861	144,878	9,031	62,000	120,000	224,861	562,631
1889–90	2,203	124,772	8,159	55,000	120,000	142,554	452,688
1889–90 (Census)	....	*130,413*	*4,089*	....	....	....	....
1890–91	3,459	215,844	6,107	50,000	125,000	136,035	536,445
1891–92	5,356	160,937	4,500	70,000	115,598	248,806	605,197
1892–93	12,018	217,525	5,000	50,000	140,000	257,392	681,935
1893–94	19,950	265,856	6,854	60,000	136,689	207,319	696,648
1894–95	20,092	317,334	8,288	52,500	131,698	336,076	865,988
1895–96	29,220	237,721	4,973	50,000	201,632	230,000	753,546
1896–97	37,536	282,009	5,570	58,000	224,218	202,000	809,333
1897–98	40,398	310,447	5,737	54,000	204,833	178,000	793,415
1898–99	32,471	245,512	3,442	53,826	252,507	93,000	680,758
1898–99 (Census)	....	*248,658*	c *5,266*	....	....	....	....
1899–1900	72,944	147,164	2,027	35,000	258,521	62,785	578,441
1899–1900 (Census)	*72,972*	*142,485*	*1,510*	....	*242,008*	....	....
1900–1	76,859	270,338	2,891	80,000	321,461	55,400	806,949
1901–2	164,827	321,676	3,614	85,000	317,509	78,637	971,263
1902–3	194,782	329,226	3,722	85,000	391,062	90,000	1,093,792
1902 (Census)	....	....	....	....	....	*177,371*	....
1903–4	214,825	228,477	c 19,800	130,000	328,103	84,000	1,005,205
1904–5	216,173	335,000	c 15,000	145,000	380,576	106,875	1,198,624
1904–5 (Census)	*226,715*	....	....	....	....	....	....
1905–6	279,393	330,000	c 12,000	213,000	383,225	145,525	1,363,143
1906–7	431,796	230,000	c 13,000	255,000	390,000	150,500	1,470,296

a Mean annual production; quantity varied from year to year between 300 and 500 tons.
b Production uncertain; not exceeding quantity stated.
c Texas.

Sugar-beet acreage and beet-sugar production in the United States, 1901–2 to 1906–7.

[From reports of Department of Agriculture on Progress of the Beet-Sugar Industry in the United States. Full explanations of the table are given in the report for 1906.]

State and year.	Factories in operation.	Area harvested.	Average yield of beets per acre.	Beets worked.	Sugar manufactured.	Average extraction of sugar.	Average sugar in beets.	Average purity coefficient of beets.	Average length of campaign.
1906–7.	*No.*	*Acres.*	*Short tons.*	*Short tons.*	*Pounds.*	*Per cent.*	*Per cent.*		*Days.*
California	8	60,141	11.17	671,571	185,480,000	13.81	16.7	82.7	115
Colorado	15	110,943	13.41	1,487,383	334,386,000	11.24	14.7	80.3	132
Idaho	4	19,950	11.48	229,023	56,798,000	12.40	16.9	86.8	95
Michigan	16	93,984	8.57	805,309	177,214,000	11.00	14.5	83.2	85
Nebraska	2	13,650	9.77	133,387	30,754,000	11.53	13.7	80.6	136
Utah	5	24,108	15.88	382,769	80,848,000	10.56	14.5	81.8	123
Wisconsin	4	15,560	10.19	158,600	35,220,000	11.10	13.6	83.0	83
Nine States having one factory each	9	37,738	9.75	368,070	66,524,000	9.04	14.4	81.2	86
Total or average, 1906–7	63	376,074	11.26	4,236,112	967,224,000	11.42	14.9	82.2	105
1905–6	52	307,364	8.67	2,665,913	625,841,228	11.74	15.3	83.0	77
1904–5	48	197,784	10.47	2,071,539	484,226,430	11.69	15.3	83.1	78
1903–4	49	242,576	8.56	2,076,494	481,209,087	11.59	15.1	(a)	75
1902–3	41	216,400	8.76	1,895,812	436,811,685	11.52	14.6	83.3	94
1901–2	36	175,083	9.63	1,685,689	369,211,733	10.95	14.8	82.2	88

a No data.

CACAO.

Cacao crop of countries named, 1902–1906.

[This table, taken from the Gordian, Hamburg, purports to cover the entire production of the world.]

Country.	1902.	1903.	1904.	1905.	1906.a
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
St. Thomas (Portuguese)	39,615,000	47,291,000	45,252,000	55,952,000	51,800,000
Ecuador	55,040,000	51,232,000	62,685,000	46,579,000	54,900,000
Brazil	44,910,000	45,720,000	51,059,000	46,496,000	60,400,000
Trinidad	35,176,000	32,818,000	40,949,000	44,133,000	35,100,000
Santo Domingo	19,786,000	17,251,000	29,890,000	28,185,000	30,200,000
Venezuela	21,881,000	27,670,000	28,768,000	25,795,000	24,300,000
Gold Coast (Lagos)	5,372,000	5,064,000	12,540,000	12,491,000	13,400,000
Grenada	13,173,000	13,558,000	13,727,000	12,028,000	10,400,000
Ceylon	5,893,000	6,780,000	7,176,000	7,810,000	8,400,000
Cuba and Porto Rico	4,134,000	5,787,000	7,201,000	6,614,000	6,600,000
Haiti	4,387,000	4,795,000	5,581,000	5,166,000	5,500,000
Dutch Guiana	5,192,000	4,905,000	1,883,000	3,553,000	4,400,000
Dutch East Indies	1,962,000	3,215,000	2,513,000	3,289,000	3,700,000
Jamaica	3,362,000	3,638,000	3,638,000	3,273,000	4,900,000
French West Indies	2,039,000	2,535,000	2,678,000	2,646,000	3,100,000
Kamerun, Samoa	1,429,000	1,764,000	2,445,000	2,613,000	3,500,000
St. Lucia	1,731,000	1,764,000	1,764,000	1,543,000	1,800,000
Dominica	....	....	1,070,000	1,315,000	1,300,000
Kongo Free State	....	....	510,000	429,000	400,000
Other countries	1,543,000	1,764,000	1,764,000	1,764,000	2,200,000
Total	266,625,000	277,551,000	323,093,000	311,674,000	326,300,000

a Preliminary estimate.

Cacao consumption of countries named, 1902–1906.

[From the Gordian, Hamburg.]

Country.	1902.	1903.	1904.	1905.	1906.[a]
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
United States	50,973,000	62,850,000	73,104,000	77,070,000	78,480,000
Germany	45,419,000	47,380,000	59,748,000	65,330,000	75,400,000
France	42,644,000	45,500,000	48,060,000	47,945,000	51,260,000
England	44,943,000	38,550,000	45,311,000	46,531,000	46,960,000
Netherlands (net imports)	20,222,000	23,657,000	26,862,000	23,672,000	24,690,000
Spain	20,415,000	13,242,000	12,370,000	13,452,000	13,670,000
Switzerland	12,582,000	12,911,000	15,078,000	11,505,000	14,110,000
Belgium	5,021,000	6,102,000	6,155,000	6,656,000	7,060,000
Austria-Hungary	4,013,000	4,485,000	5,534,000	5,883,000	6,610,000
Russia	4,008,000	4,190,000	4,532,000	4,917,000	5,510,000
Denmark	1,768,000	2,535,000	2,196,000	2,480,000	2,650,000
Italy	1,028,000	1,032,000	1,057,000	2,142,000	2,430,000
Sweden	1,304,000	1,708,000	1,920,000	1,984,000	2,210,000
Canada	689,000	1,291,000	1,433,000	1,543,000	1,650,000
Australia	1,223,000	979,000	1,213,000	1,323,000	1,430,000
Norway	904,000	970,000	1,041,000	1,089,000	1,210,000
Portugal	248,000	301,000	397,000	304,000	330,000
Finland	104,000	135,000	139,000	132,000	140,000
Total	257,508,000	267,818,000	306,150,000	313,958,000	335,800,000

[a] Preliminary estimate.

TEA.

International trade in tea, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
British India	Apr. 1	182,997,444	183,985,406	209,599,041	215,681,204	229,147,998
Ceylon	Jan. 1	144,275,608	150,829,707	149,227,236	157,929,342	170,183,572
China	Jan. 1	154,399,067	202,561,467	223,670,667	193,499,867	182,573,067
Dutch East Indies	Jan. 1	17,298,690	15,637,322	21,333,166	26,011,407	26,143,823
Formosa	Jan. 1	19,926,072	21,892,865	23,949,974	21,735,627	23,779,542
Japan	Jan. 1	43,981,077	43,334,372	47,858,393	47,108,862	38,566,526
Singapore	Jan. 1	2,222,667	1,903,867	1,955,067	2,752,933	[b] 2,208,633
Other countries		3,891,000	4,437,000	4,692,000	5,428,000	[b] 4,612,000
Total		568,991,625	624,582,006	682,285,544	670,147,182	677,215,161

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Argentina	Jan. 1	1,648,156	1,652,823	1,798,310	2,418,217	2,314,238
Australia	Jan. 1	27,018,196	24,822,544	24,716,426	28,688,974	28,353,903
Austria-Hungary	Jan. 1	2,257,092	2,258,194	2,364,457	2,662,742	2,755,998
British India	Apr. 1	3,386,557	3,921,563	4,817,821	5,135,126	5,520,643
Canada	July 1	19,530,654	23,969,371	31,360,014	26,314,242	25,632,627
Cape of Good Hope	Jan. 1	3,169,031	4,512,958	3,793,311	3,322,815	3,254,298
Chile	Jan. 1	1,924,379	1,883,307	1,977,766	1,760,302	2,427,520
Dutch East Indies	Jan. 1	4,060,900	4,218,013	4,458,883	4,044,820	[b] 4,195,654
France	Jan. 1	1,899,974	2,084,587	2,249,722	2,446,200	2,348,152
French Indo-China	Jan. 1	2,785,335	2,968,707	2,947,659	3,436,080	3,034,445
Germany [c]	Jan. 1	7,275,253	7,501,667	6,805,889	7,168,769	6,900,908
Netherlands	Jan. 1	7,956,562	7,989,226	7,926,262	8,794,208	9,090,607
New Zealand	Jan. 1	5,508,610	5,088,581	5,232,721	5,225,668	5,906,653
Persia	Mar. 1	[d] 6,353,224	[d] 6,353,224	6,922,170	5,784,277	[d] 6,353,224
Russia	Jan. 1	125,924,142	135,608,295	132,670,193	121,648,892	[e] 112,584,435
Singapore	Jan. 1	4,179,333	4,201,200	4,243,467	4,602,533	[b] 4,306,633
United Kingdom	Jan. 1	252,603,527	247,876,714	260,627,026	270,514,472	267,997,328
United States	July 1	75,579,125	108,574,905	112,905,541	102,706,599	93,621,750
Other countries		12,365,000	17,169,000	15,884,000	11,025,000	[b] 14,111,000
Total		565,425,050	612,654,879	633,701,638	617,699,936	600,710,016

[a] See "General note," p. 546.
[b] Average, 1901–1904.
[c] Not including free ports.
[d] Average, 1903–1904.
[e] Preliminary figures.

COFFEE.

International trade in coffee, 1901-1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Brazil	Jan. 1	1,952,404,204	1,740,434,770	1,709,984,152	1,326,027,795	1,431,328,038
British India	Apr. 1	28,564,704	30,146,480	32,620,448	35,920,464	40,340,384
Colombia [b]	Jan. 1	55,000,000	60,000,000	100,000,000	130,000,000	70,000,000
Costa Rica	[c] Sept. 1	36,539,460	30,311,568	38,211,860	27,730,672	39,788,002
Dutch East Indies	Jan. 1	72,185,647	115,448,887	116,334,830	77,168,254	72,864,649
Guatemala	Jan. 1	75,414,600	85,674,400	63,150,500	71,653,700	81,081,600
Haiti	[c] Oct. 1	58,123,824	64,428,104	47,853,529	81,407,346	45,244,232
Jamaica	Apr. 1	11,551,557	12,079,872	8,966,832	5,781,440	9,046,464
Mexico	July 1	48,949,705	41,837,859	40,698,861	[d] 41,855,368	[d] 42,456,491
Netherlands	Jan. 1	164,050,182	168,524,286	181,196,786	166,468,567	148,744,186
Nicaragua	Jan. 1	12,963,920	19,628,876	18,431,643	21,661,621	18,171,515
Salvador	July 1	50,101,756	41,619,090	58,097,158	75,314,003	61,822,223
Singapore	Jan. 1	9,621,067	12,355,333	15,125,067	10,638,667	[e] 11,935,034
United States	July 1	27,532,353	29,768,945	32,614,390	16,109,251	29,184,504
Venezuela	July 1	[b] 108,000,000	71,206,846	125,582,423	[b] 128,000,000	94,370,090
Other countries	....	30,107,000	41,723,000	35,375,000	61,609,000	[e] 42,204,000
Total	....	2,741,109,979	2,565,188,316	2,624,243,479	2,278,346,148	2,238,581,412

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Argentina	Jan. 1	13,684,999	12,117,621	18,502,868	16,931,049	18,516,812
Austria-Hungary	Jan. 1	99,056,753	99,434,846	104,200,357	108,701,092	107,106,048
Belgium	Jan. 1	71,971,468	69,660,936	51,859,425	154,387,057	100,032,285
Cape of Good Hope	Jan. 1	18,060,924	25,818,323	20,979,803	19,448,590	21,136,170
Cuba	Jan. 1	20,611,122	21,133,898	17,218,114	20,716,876	[e] 19,920,002
Denmark	Jan. 1	20,873,361	23,381,119	24,369,892	25,552,671	25,348,744
Egypt	Jan. 1	10,694,613	13,991,788	13,196,168	12,789,537	13,996,858
Finland	Jan. 1	19,565,782	22,130,291	25,598,739	23,291,871	25,743,433
France	Jan. 1	185,780,736	189,253,397	246,122,708	168,198,472	200,594,621
Germany [f]	Jan. 1	380,935,533	379,945,878	403,070,820	398,486,529	398,491,379
Italy	Jan. 1	35,059,001	35,846,933	38,934,065	39,087,728	[d] 41,285,969
Netherlands	Jan. 1	261,942,004	291,984,983	259,525,128	193,836,257	206,246,193
Norway	Jan. 1	27,441,922	28,340,658	27,996,473	23,699,731	25,298,346
Russia	Jan. 1	20,553,961	21,483,649	21,320,455	20,976,264	[d] 21,559,342
Singapore	Jan. 1	9,624,533	13,046,800	14,958,400	9,174,666	11,701,100
Spain	Jan. 1	22,995,484	20,419,436	21,851,660	22,000,781	[e] 21,816,840
Sweden	Jan. 1	68,455,098	57,555,152	68,349,071	60,623,344	66,417,080
Switzerland	Jan. 1	20,712,644	22,313,200	23,671,026	22,562,322	20,958,680
United Kingdom	Jan. 1	31,568,658	62,344,279	51,017,884	39,508,156	493,275
United States	July 1	1,091,004,252	915,086,380	995,043,284	1,047,792,984	851,668,933
Other countries	....	48,660,000	61,248,000	78,221,000	51,137,000	[e] 59,816,000
Total	....	2,479,252,848	2,386,537,567	2,526,007,340	2,478,902,977	2,258,148,110

[a] See "General note," p. 546.
[b] Estimated.
[c] Year preceding.
[d] Preliminary figures.
[e] Average, 1901-1904.
[f] Not including free ports.

OIL CAKE AND OIL-CAKE MEAL.

International trade in oil cake and oil-cake meal, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	20,518,417	18,984,000	19,989,308	29,019,439	29,277,380
Austria-Hungary	Jan. 1	59,327,039	64,246,433	88,614,781	92,352,938	77,134,433
Belgium	Jan. 1	132,103,005	128,843,692	137,066,773	145,834,669	160,163,061
Canada	July 1	20,745,648	28,830,032	29,002,624	10,115,392	26,227,376
China	Jan. 1	89,672,067	89,672,067	89,672,067	83,999,467	95,344,667
Denmark	Jan. 1	7,522,545	4,045,586	8,682,295	4,417,928	5,676,571
Egypt	Jan. 1	107,812,630	130,544,487	156,944,836	160,794,106	147,961,001
France	Jan. 1	242,983,580	325,867,127	314,693,035	351,628,964	339,529,396
Germany [b]	Jan. 1	299,993,939	328,769,326	375,254,222	436,964,238	397,800,450
Italy	Jan. 1	26,508,816	24,908,481	19,627,750	24,696,396	[c] 24,425,228
Netherlands	Jan. 1	154,833,546	139,814,583	136,734,208	154,525,289	143,290,470
Russia	Jan. 1	850,865,092	850,095,204	1,028,500,994	1,084,331,094	[c] 977,465,158
United Kingdom	Jan. 1	53,146,240	53,146,240	53,146,240	48,462,400	57,830,080
United States	July 1	1,648,093,619	1,679,394,359	1,503,232,680	1,894,577,648	1,918,171,984
Other countries		7,298,000	11,491,000	14,337,000	26,149,000	[d] 26,149,000
Total		3,721,424,183	3,878,652,617	3,975,498,813	4,547,868,968	4,426,446,255

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Austria-Hungary	Jan. 1	16,879,909	7,656,432	21,750,580	27,340,840	26,469,794
Belgium	Jan. 1	322,948,926	353,641,510	421,696,899	445,202,134	448,216,564
Canada	July 1	7,683,200	3,521,616	3,808,224	3,953,376	2,308,432
Denmark	Jan. 1	524,125,732	654,111,347	776,875,723	757,481,664	840,119 715
Dutch East Indies	Jan. 1	17,963,013	15,691,801	15,977,041	31,004,951	20,159,201
Finland	Jan. 1	10,405,942	12,594,155	7,205,192	13,948,954	11,179,475
France	Jan. 1	255,172,170	238,507,681	279,980,299	292,015,079	323,719,234
Germany [b]	Jan. 1	1,180,863,666	1,074,490,655	1,108,355,853	1,231,409,255	1,285,529,859
Italy	Jan. 1	12,593,462	7,909,522	9,645,221	6,525,902	[c] 5,209,963
Japan	Jan. 1	78,582,800	55,550,267	71,402,800	73,540,133	101,574,267
Netherlands	Jan. 1	429,765,565	461,479,090	476,967,295	495,921,130	510,951,427
Sweden	Jan. 1	119,861,354	142,046,653	163,933,913	219,913,686	226,374,498
United Kingdom	Jan. 1	842,437,120	861,678,720	811,798,400	823,934,720	797,368,320
Other countries		18,751,000	21,898,000	25,702,000	54,076,000	[d] 54,076,000
Total		3,838,033,859	3,910,777,449	4,195,099,440	4,476,267,824	4,653,256,749

[a] See "General note" p. 546.
[b] Not including free ports.
[c] Preliminary figures.
[d] Figures for 1904 used.

RESIN.

International trade in resin, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	3,621,312	3,378,583	3,327,436	3,627,485	3,372,410
Germany [b]	Jan. 1	42,257,533	33,756,511	44,552,765	45,617,597	46,370,255
Netherlands	Jan. 1	65,473,834	74,856,747	63,038,801	83,943,225	58,544,509
United States	July 1	710,069,360	671,019,440	723,830,240	646,877,000	682,795,680
Other countries		252,000	288,000	373,000	338,000	[c] 177,000
Total		821,674,039	783,299,281	835,122,242	780,403,307	791,259,854

[a] See "General note," p. 546. [b] Not including free ports. [c] Preliminary figures.

International trade in resin, 1901–1906—Continued.

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	20,218,335	18,292,214	19,761,229	27,846,066	20,409,438
Austria-Hungary	Jan. 1	79,556,651	58,450,261	72,122,004	64,824,926	62,482,294
Brazil	Jan. 1	22,966,365	23,552,810	26,729,827	26,297,077	[c] 27,491,036
Canada	July 1	14,830,480	17,988,880	29,357,280	19,116,272	23,027,744
Chile	Jan. 1	1,576,585	2,348,919	3,844,971	1,935,923	2,045,007
Cuba	Jan. 1	2,369,649	3,076,821	2,963,173	2,184,454	[b] 2,648,524
Denmark	Jan. 1	2,414,061	2,338,002	1,630,318	2,135,176	2,033,764
Finland	Jan. 1	3,619,520	3,071,429	4,397,180	3,380,950	5,133,032
France	Jan. 1	1,023,414	1,007,975	905,121	793,596	693,940
Germany [c d]	Jan. 1	235,125,141	197,538,981	236,486,074	233,541,761	208,295,753
Italy	Jan. 1	30,976,262	29,474,694	25,020,035	32,527,875	[a] 27,539,477
Japan	Jan. 1	3,509,264	5,011,866	3,275,449	5,463,167	6,378,919
Netherlands	Jan. 1	73,173,408	94,202,927	68,258,734	89,750,004	78,666,949
Russia	Jan. 1	66,196,279	65,531,334	67,526,025	65,403,091	59,405,556
Servia	Jan. 1	8,157,342	1,626,832	6,751,840	4,887,352	7,894,169
Spain	Jan. 1	6,228,048	5,399,144	4,823,960	3,983,117	[b] 5,108,567
Sweden	Jan. 1	8,531,696	11,123,176	9,940,220	13,440,652	11,443,057
Switzerland	Jan. 1	5,292,636	5,127,510	6,297,002	6,040,101	5,736,867
United Kingdom	Jan. 1	194,034,400	202,016,416	183,607,872	199,577,952	177,010,024
Uruguay	July 1	5,920,953	5,494,359	4,390,394	[e] 5,268,569	[e] 5,268,569
Other countries		3,367,000	4,316,000	2,821,000	9,868,000	[a] 7,418,000
Total		789,378,489	756,990,550	780,887,548	818,972,118	746,132,286

[a] Preliminary figures.
[b] Average, 1901–1904.
[c] Not including free ports.
[d] Including turpentine.
[e] Average, 1901–1903.

SPIRITS OF TURPENTINE.

International trade in spirits of turpentine, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Gallons.	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
France	Jan. 1	833,927	925,794	1,975,963	1,459,297	3,179,105
Germany[b]	Jan. 1	565,179	502,439	612,058	569,650	520,750
Netherlands	Jan. 1	941,527	1,288,879	988,059	876,929	972,714
Russia	Jan. 1	1,483,439	1,516,096	1,887,430	2,163,759	2,507,833
United States	July 1	19,177,788	16,378,787	17,202,808	15,894,813	15,981,253
Other countries		60,318	60,266	71,979	112,536	[c] 76,275
Total		23,062,178	20,672,261	22,738,297	21,076,984	23,237,930

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Argentina	Jan. 1	254,235	252,958	276,360	344,877	290,192
Australia	Jan. 1	557,314	213,099	226,272	437,032	291,809
Canada	July 1	875,061	941,003	817,020	963,138	1,077,989
Chile	Jan. 1	78,874	69,044	163,911	85,896	134,191
Germany[b]	Jan. 1	8,435,772	8,077,490	8,300,249	8,438,956	8,539,910
Italy	Jan. 1	658,416	663,193	771,465	816,629	687,291
Netherlands	Jan. 1	1,895,567	3,245,616	2,729,815	2,220,156	2,248,055
New Zealand	Jan. 1	129,888	130,881	69,596	285,031	153,999
Russia	Jan. 1	217,028	142,746	201,133	204,734	190,595
Sweden	Jan. 1	140,774	124,723	126,194	138,884	115,383
Switzerland	Jan. 1	322,457	313,363	360,303	372,367	346,279
United Kingdom	Jan. 1	9,701,051	7,942,324	8,012,184	7,907,418	7,693,933
Other countries		515,546	407,711	493,579	584,069	[c] 500,376
Total		23,781,983	22,524,131	22,548,081	22,800,387	22,270,002

[a] See "General note," p. 546.
[b] Not including free ports.
[c] Preliminary figures.

INDIA RUBBER.

International trade in india rubber, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Angola[b]	Jan. 1	[illegible]	[illegible]	[illegible]	6,000,000	5,[illegible],000
Belgium	Jan. 1	14,194,324	13,0[illegible]	14,088,5[illegible]	[illegible]	14,967,420
Bolivia	Jan. 1	7,[illegible],154	4,165,[illegible]	2,912,[illegible]81	4,915,[illegible]	3,728,726
Brazil	Jan. 1	[illegible],848	63,122,428	69,923,121	70,251,[illegible]	78,027,[illegible]29
Dutch East Indies	Jan. 1	504,406	42[illegible],848	1,475,551	[illegible],480	[e] 3,590,[illegible]
Ecuador	Jan. 1	710,713	870,405	1,000,[illegible]	1,145,447	1,28[illegible],[illegible]24
France	Jan. 1	6,[illegible],028	6,011,956	6,390,101	6,632,627	10,7[illegible],[illegible]77
French Guinea	Jan. 1	[b] 1,455,000	[b] 2,42[illegible],000	3,28[illegible],045	2,951,245	2,528,[illegible]22
French Kongo	Jan. 1	1,443,450	1,518,409	1,857,491	2,75[illegible],778	[d] 1,8[illegible],297
Germany[c]	Jan. 1	11,05[illegible],[illegible]08	13,748,023	11,237,840	10,07[illegible]	17,[illegible]07,105
Gold Coast Colony	Jan. 1	1,520,000	1,509,974	2,258,981	4,01[illegible],887	3,687,778
Ivory Coast	Jan. 1	1,551,876	2,011,471	2,572,579	[illegible]	[d] 2,[illegible],030
Kamerun	Jan. 1	1,115,234	9[illegible]5,441	1,822,144	1,920,354	2,141,777
Kongo Free State	Jan. 1	13,277,859	11,7[illegible]5,724	[b] 13,[illegible],000	[b] 10,040,000	10,718,[illegible]58
Netherlands	Jan. 1	2,9[illegible],044	3,544,851	3,231,008	3,[illegible],671	5,7[illegible],824
Peru	Jan. 1	3,8[illegible],240	3,749,700	4,048,000	4,8[illegible],040	4,2[illegible],100
Senegal	Jan. 1	736,812	1,212,262	1,891,957	2,208,023	1,504,914
Singapore	Jan. 1	1,139,867	920,533	1,441,200	3,026,133	[d] 1,[illegible]
Southern Nigeria Protectorate	Jan. 1	1,740,156	865,834	1,177,803	2,408,926	2,842,831
Venezuela	July 1	[f] 1,673,[illegible]08	1,67[illegible]	1,794,[illegible]	[g] 2,[illegible]	2,876,110
Other countries		5,763,000	4,[illegible]4,000	5,970,000	8,921,000	[h] 3,525,000
Total		150,[illegible],054	141,909,020	158,324,182	171,896,688	180,686,594

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Austria-Hungary	Jan. 1	2,649,294	2,640,476	2,789,598	2,935,675	3,021,875
Belgium	Jan. 1	15,388,376	15,9[illegible]	16,977,346	17,98[illegible]	18,744,493
Canada	July 1	2,[illegible],080	2,858,778	3,21[illegible],277	2,81[illegible],298	2,4[illegible],756
France	Jan. 1	11,745,093	12,9[illegible]4	12,708,795	14,611,040	19,69[illegible]
Germany[e]	Jan. 1	28,709,470	33,132,823	34,[illegible]62,782	38,375,855	47,1[illegible],478
Italy	Jan. 1	1,405,447	1,556,022	1,47[illegible],042	1,474,451	[h] 1,[illegible]90,725
Netherlands	Jan. 1	3,718,457	4,15[illegible],714	4,422,284	5,371,310	6,[illegible]45,498
Russia	Jan. 1	12,119,275	10,960,379	14,[illegible]88,124	1[illegible],934,7[illegible]	[h] 13,072,8[illegible]4
United Kingdom	Jan. 1	19,340,[illegible]84	14,2[illegible],888	1[illegible],784,962	22,140,048	2[illegible],[illegible]82
United States	July 1	50,41[illegible],481	55,010,571	5[illegible],[illegible]5,551	67,234,2[illegible]	57,844,245
Other countries		3,446,000	3,026,000	3,92[illegible],000	8,091,000	[h] 6,926,000
Total		151,888,957	155,908,855	170,058,[illegible]1	194,091,[illegible]	206,293,794

[a] See "General note," p. 546.
[b] Estimated.
[c] Exports in 1904.
[d] Average, 1901–1904.
[e] Not including free ports.
[f] Exports in 1902.
[g] Average, 1903–1905.
[h] Preliminary figures.

WOOD PULP.

International trade in wood pulp, 1901–1906.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary	Jan. 1	92,454,068	98,315,779	105,874,767	147,2[illegible],342	1[illegible],252,529
Belgium	Jan. 1	63,078,559	57,585,053	55,958,478	68,359,246	54,872,[illegible]25
Canada[b]	July 1	176,960,000	309,120,000	271,040,000	569,000,000	361,870,000
Finland	Jan. 1	58,016,833	57,060,121	80,804,723	130,027,777	133,477,[illegible]20
Germany[c]	Jan. 1	136,671,573	185,744,254	161,354,520	155,086,119	15[illegible],[illegible]51
Norway	Jan. 1	844,031,023	986,501,986	987,105,611	981,629,727	975,1[illegible],454
Sweden	Jan. 1	510,238,031	632,302,111	790,80[illegible],214	865,367,[illegible]83	84[illegible],21[illegible],5[illegible]5
Switzerland	Jan. 1	13,703,269	12,550,693	15,455,503	14,938,9[illegible]	14,004,420
United States	July 1	38,348,632	22,464,472	30,2[illegible],820	23,70[illegible]	2[illegible],48[illegible],494
Other countries		974,000	511,000	505,000	3,137,000	5,199,000
Total		1,934,455,988	2,362,155,469	2,499,135,636	2,759,086,460	2,740,159,968

[a] See "General note," p. 546. [b] Estimated. [c] Not including free ports.

International trade in wood pulp, 1901-1906—Continued.

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	13,491,861	14,967,598	26,578,411	35,123,171	30,886,404
Austria-Hungary	Jan. 1	12,301,316	7,271,725	4,981,343	5,342,681	4,702,018
Belgium	Jan. 1	147,848,801	183,481,383	159,206,350	177,288,153	174,530,060
Denmark	Jan. 1	58,337,522	60,458,958	61,638,806	64,505,845	67,310,417
France	Jan. 1	390,857,395	437,465,059	420,541,812	465,941,055	490,998,886
Germany[a]	Jan. 1	132,496,459	63,259,203	91,195,732	155,901,554	109,748,067
Italy	Jan. 1	59,077,256	58,479,583	67,924,624	85,246,119	[b] 93,706,762
Japan	Jan. 1	3,978,974	8,292,550	16,039,691	22,726,098	22,769,993
Russia	Jan. 1	69,780,583	68,889,680	57,929,301	49,107,233	[b] 44,382,631
Spain	Jan. 1	57,174,279	73,125,213	59,570,926	62,509,816	59,570,926
Sweden	Jan. 1	6,446,121	5,464,912	5,657,726	6,918,145	6,579,205
Switzerland	Jan. 1	6,329,911	6,948,016	10,344,527	14,229,512	19,680,440
United Kingdom	Jan. 1	994,591,360	1,170,881,600	1,281,295,680	1,263,028,480	1,280,780,480
United States	July 1	151,911,840	201,818,440	324,848,040	275,208,960	352,181,760
Other countries		999,000	5,999,000	12,693,000	2,753,000	947,000
Total		2,069,782,678	2,426,792,920	2,599,940,969	2,786,079,125	2,758,835,049

[a] Not including free ports.

[b] Preliminary figures.

SILK.

Raw silk production of countries named, 1901-1905.

[Estimate of the Silk Manufacturers' Association of Lyons.]

Country.	1901.	1902.	1903.	1904.	1905.
Western Europe:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Italy	9,458,000	9,870,000	7,774,000	10,809,000	9,788,000
France	1,442,000	1,257,000	1,045,000	1,378,000	1,393,000
Spain	176,000	172,000	190,000	170,000	172,000
Austria-Hungary	717,000	688,000	606,000	694,000	761,000
Total	11,793,000	11,987,000	9,615,000	13,045,000	12,114,000
Levant and Central Asia:					
Anatolia	922,000	1,109,000	1,160,000	1,096,000	1,424,000
Syria and Cyprus	967,000	1,190,000	1,124,000	1,059,000	1,080,000
Salonica and Adrianople	441,000	419,000	547,000	564,000	617,000
Balkan states	212,000	257,000	300,000	357,000	419,000
Greece and Crete	132,000	148,000	132,000	141,000	155,000
Caucasus	976,000	1,025,000	882,000	794,000	640,000
Persia and Turkestan (exports)	592,000	1,213,000	1,433,000	939,000	1,014,000
Total	4,170,000	5,386,000	5,578,000	4,909,000	5,349,000
Far East:					
China—					
Exports from Shanghai	11,164,000	7,937,000	9,256,000	9,293,000	8,841,000
Exports from Canton	4,722,000	4,892,000	4,743,000	4,705,000	4,409,000
Japan—					
Exports from Yokohama	9,921,000	10,516,000	10,159,000	12,846,000	10,183,000
British India—					
Exports from Calcutta and Bombay[a]	617,000	650,000	540,000	397,000	617,000
Total	26,424,000	23,995,000	24,788,000	27,241,000	24,050,000
Grand total	42,390,000	41,368,000	39,981,000	45,195,000	41,513,000

[a] Exports from Bombay included for the first time in 1905.

BEANS.

Wholesale prices of beans per bushel in leading cities of the United States, 1902–1906.

Date.	Boston.		Cincinnati.		Chicago.		Detroit.		San Francisco.	
	Pea.		Pea.		Pea.		Pea.		Lima (per cwt.).	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.										
January	$1.80	$2.05	$2.60	$2.70	$1.40	$1.83	$1.60	$1.79	$4.40	$4.65
February	1.80	1.85	2.60	2.70	1.40	1.75	1.53	1.62	4.40	4.60
March	1.70	1.80	2.60	2.70	1.20	1.65	1.28	1.51	4.35	4.40
April	1.60	1.75	2.30	2.70	.85	1.80	1.28	1.62	3.30	3.60
May	1.75	1.90	2.30	2.60	1.50	1.85	1.56	1.75	3.60	3.80
June	1.65	1.70	2.30	2.60	1.50	1.70	1.48	1.60	3.60	3.85
July	1.80	2.15	2.30	2.50	1.60	1.90	1.60	1.90	3.60	3.85
August	1.95	2.10	2.30	2.50	1.60	1.96	1.63	1.90	3.80	4.10
September	1.90	2.00	2.30	2.50	1.60	1.90	1.75	1.85	3.70	3.90
October	2.15	2.55	2.25	2.50	1.78	2.49	1.70	1.98	4.10	4.35
November	2.35	2.45	2.20	2.40	2.15	2.30	1.66	1.88	4.20	4.50
December	2.30	2.40	2.25	2.40	2.15	2.30	1.74	1.81	4.25	4.55
1903.			Navy.						Small white.	
January	2.40	2.45	2.40	2.50	1.25	2.40	2.24	2.35	2.90	3.40
February	2.35	2.40	2.25	2.50	1.20	2.30	2.10	2.23	2.90	3.35
March	2.25	2.30	2.30	2.40	1.25	2.25	2.10	2.16	3.00	3.30
April	2.25	2.30	2.15	2.40	.90	2.20	1.88	2.10	3.00	3.30
May	2.25	2.35	2.15	2.25	.90	2.30	2.07	2.35	2.90	3.25
June	2.35	2.35	2.15	2.25	1.25	2.35	2.20	2.25	3.00	3.25
July	2.30	2.35	2.15	2.25	1.20	2.23	2.10	2.21	3.00	3.25
August	2.20	2.30	2.15	2.25	1.15	2.25	1.91	1.96	3.00	3.20
September	2.30	2.40	2.15	2.25	1.50	2.50	2.10	2.35	2.85	3.25
October	2.25	2.40	2.15	2.25	1.05	2.25	1.90	2.28	3.00	3.25
November	2.15	2.20	2.15	2.25	1.05	2.15	1.90	2.00	2.75	3.15
December	2.10	2.15	2.05	2.25	1.35	2.00	1.82	1.90	2.40	3.00
1904.										
January	2.00	2.10	2.05	2.10	1.00	1.90	1.75	1.77	2.75	3.00
February	2.00	2.20	2.05	2.10	1.25	2.05	1.74	1.98	2.80	3.00
March	2.00	2.20	2.05	2.10	1.25	2.05	1.70	1.95	2.85	3.10
April	1.95	2.00	2.05	2.10	1.00	1.85	1.70	1.80	2.90	3.15
May	1.95	2.00	2.05	2.10	1.10	1.80	1.70	1.87	2.95	3.10
June	1.85	1.95	2.05	2.10	1.10	1.78	1.60	1.70	2.90	3.05
July	1.80	1.80	2.05	2.10	1.10	1.70	1.60	1.61	2.75	3.00
August	1.75	1.90	2.05	2.10	1.10	1.65	1.61	1.78	2.75	3.00
September	1.75	1.90	2.05	2.10	.90	1.65	....	....	2.75	3.10
October	1.85	1.95	2.05	2.10	.90	1.75	1.65	1.72	2.75	3.32½
November	1.80	1.85	1.80	1.90	1.10	1.70	1.58	1.64	2.75	3.30
December	1.72½	1.80	1.80	1.90	1.20	1.70	1.58	1.62	2.75	3.30
1905.										
January	1.75	1.75	1.80	1.90	1.25	1.62	1.56	1.65	2.75	3.30
February	1.75	2.00	1.80	1.90	1.00	1.85	1.52	1.85	2.75	3.30
March	1.80	1.97	1.80	1.90	1.30	1.80	1.70	1.77	2.75	3.45
April	1.75	1.80	1.80	1.90	1.30	1.70	1.66	1.75	2.75	3.45
May	1.75	1.80	1.80	1.90	1.30	1.70	1.62	1.68	2.75	3.40
June	1.80	1.90	1.80	1.90	1.30	1.75	1.65	1.69	2.75	3.50
July	1.85	1.90	1.80	1.90	1.25	1.78	1.66	1.68	2.75	3.60
August	1.75	1.85	1.80	1.90	1.20	1.72½	1.55	1.63	2.75	3.60
September	1.75	1.75	1.80	1.90	1.25	1.68	1.50	1.65	3.00	3.60
October	1.75	1.75	1.65	1.75	1.25	1.65	1.49	1.63	3.00	3.60
November	1.75	1.85	1.65	1.75	1.40	1.70	1.55	1.68	2.75	3.15
December	1.75	1.85	1.65	1.75	1.40	1.70	1.55	1.65	2.75	3.20
1906.										
January	1.75	1.80	1.65	1.75	1.40	1.62	1.55	1.61	....	....
February	1.65	1.75	1.65	1.75	1.37	1.58	1.45	1.55	....	....
March	1.55	1.60	1.65	1.75	1.35	1.55	1.40	1.47	....	....
April	1.60	1.65	1.65	1.75	1.10	1.62	1.44	1.52	....	....
May	1.60	1.70	1.65	1.75	1.20	1.62	1.48	1.54	....	....
June	1.60	1.72	1.65	1.75	1.25	1.65	1.48	1.55	....	....
July	1.60	1.62	1.65	1.75	1.25	1.64	1.50	1.52	....	....
August	1.55	1.60	1.65	1.75	1.25	1.58	1.41	1.50	....	....
September	1.50	1.55	1.65	1.75	1.39	1.53	1.30	1.44	....	....
October	1.55	1.65	1.65	1.75	1.40	1.48	1.37	1.40	....	....
November	1.60	1.65	1.65	1.75	1.40	1.46	1.34	1.37	....	....
December	1.50	1.55	1.65	1.75	1.35	1.45	1.27	1.30	....	....

CLOVER AND TIMOTHY SEED.

Wholesale prices of clover seed (60 pounds to the bushel), 1902–1906.

Date.	Cincinnati.		Chicago.		Toledo.		Detroit.	
	Prime (per 100 pounds).		Poor to choice (per 100 pounds).		Prime (per bushel).		Per bushel.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.								
January	$8.65	$9.60	$7.00	$10.00	$4.25	$6.15	$5.70	$6.10
February	8.65	9.20	6.50	9.70	4.95	5.80	5.55	5.80
March	8.00	9.20	6.00	9.00	4.30	5.65	5.10	5.55
April	7.10	8.35	4.00	8.35	3.90	5.30	4.90	5.20
May	6.85	7.50	5.50	8.35	3.90	5.22½	5.00	5.20
June	6.85	7.30	6.00	8.35	4.00	5.25	Not quoted.	
July	6.85	7.50	6.00	8.40	4.10	5.30	Not quoted.	
August	7.10	8.35	6.00	9.10	4.20	5.60	Not quoted.	
September	7.10	8.35	7.00	9.50	4.25	5.65	5.15	5.90
October	7.50	8.75	7.00	11.35	4.70	7.00	5.15	5.60
November	7.50	9.20	8.00	11.15	4.75	7.10	5.35	5.65
December	8.35	9.20	8.00	10.90	5.50	6.85	5.60	5.90
1903.	Per bushel.							
January	5.25	6.50	8.50	11.90	4.40	7.42½	7.25	7.30
February	6.00	6.50	9.25	11.90	5.25	7.25	7.00	7.10
March	6.25	7.10	....	12.50	4.00	7.42½	6.95	7.40
April	6.00	6.90	5.00	12.25	3.60	7.62½	6.60	7.25
May	5.40	7.00	8.00	12.50	4.00	7.70	7.50	7.50
June	5.40	6.00	8.00	11.75	6.00	6.75	Not quoted.	
July	....	....	8.00	12.50	6.40	7.10	Not quoted.	
August	....	....	8.50	12.50	4.85	7.10	Not quoted.	
September	5.00	5.70	5.00	11.00	4.00	6.65	Not quoted.	
October	5.25	5.70	6.00	11.50	3.75	6.80	6.45	6.90
November	5.25	5.60	4.00	11.00	3.40	6.82½	6.50	6.00
December	5.25	6.00	6.00	11.25	3.05	7.05	6.80	6.95
1904.								
January	5.75	6.25	6.00	11.50	3.10	7.07½	6.75	7.00
February	5.75	6.25	6.00	11.25	4.00	7.02½	6.75	6.90
March	5.75	6.90	6.00	11.65	2.50	7.15	6.20	7.10
April	5.50	6.50	7.50	11.00	3.00	6.62½	6.20	6.55
May	4.80	5.00	6.00	10.75	3.00	6.35	6.30	6.35
June	4.80	5.00	6.00	10.75	2.50	6.25	....	....
July	4.80	5.00	7.00	11.25	3.00	6.60	6.25	6.50
August	4.80	6.50	8.00	12.75	5.70	7.60	6.50	7.50
September	6.00	6.50	9.00	12.50	3.60	7.45	7.05	7.45
October	5.50	6.75	7.00	12.25	3.00	7.52½	7.30	7.55
November	5.50	6.50	7.00	12.25	3.30	7.70	7.35	7.65
December	5.50	7.50	7.00	13.00	3.62½	7.95	7.70	7.95
1905.			(a)					
January	6.40	7.00	8.00	13.00	3.25	8.00	7.45	7.90
February	6.40	7.00	9.00	12.50	4.00	7.60	7.40	7.55
March	6.40	7.00	9.00	13.75	3.00	8.20	7.55	8.15
April	6.40	7.75	8.00	14.40	3.00	8.85	8.00	8.75
May	6.25	7.75	8.00	13.50	3.50	8.00	7.00	8.00
June	6.25	6.75	8.00	13.00	5.50	7.40	....	....
July	6.25	6.75	9.00	13.00	5.75	7.50	....	....
August	....	....	8.50	13.00	4.00	7.50	....	....
September	5.70	6.00	9.00	12.25	3.00	7.45	6.30	7.40
October	5.70	7.00	9.50	13.25	3.00	8.22½	7.50	8.25
November	6.50	7.00	10.00	13.25	4.00	8.12½	7.95	8.10
December	6.50	7.50	10.00	13.25	4.00	8.30	8.00	8.15
1906.								
January	6.50	7.50	10.00	13.25	5.00	8.35	8.10	8.30
February	6.50	7.50	10.00	14.15	4.00	8.72½	8.20	8.70
March	6.50	7.50	9.50	14.00	3.30	8.40	7.30	8.35
April	6.00	7.50	7.00	13.50	3.25	7.85	6.25	7.80
May	6.00	6.50	6.50	11.50	3.00	6.80	6.25	6.75
June	4.50	5.50	7.00	11.25	5.00	6.90	6.65	6.75
July	4.50	6.00	7.00	11.25	5.25	7.10	6.65	6.95
August	4.50	7.00	7.00	12.50	4.50	7.35	7.00	7.50
September	5.00	7.00	8.00	12.75	3.50	8.10	7.30	7.90
October	5.00	7.25	8.00	13.00	3.60	8.50	7.95	8.30
November	7.00	7.50	8.00	13.40	3.50	8.30	8.00	8.25
December	7.00	7.50	8.50	14.00	3.00	8.47½	8.20	8.40

a Poor to prime.

Wholesale prices of timothy seed (45 pounds to the bushel), 1902–1906.

Date.	Cincinnati.		Chicago.		Milwaukee.		St. Louis.[a]	
	Per 100 pounds.		Per 100 pounds.		Per 100 pounds.		Per 100 pounds.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.								
January	$6.10	$6.40	$5.00	$6.55	$5.50	$6.25	$6.30	$6.30
February	6.10	6.40	5.00	6.60	5.50	6.25	5.75	6.30
March	6.10	6.40	5.00	7.00	5.50	6.60	5.00	6.40
April	6.40	6.60	4.50	7.10	6.00	6.75	5.00	6.40
May	....	....	5.00	7.35	5.50	6.75	5.00	6.25
June	....	....	4.50	6.35	5.00	6.25	5.00	5.00
July	....	....	4.50	5.75	4.00	5.75	4.40	5.35
August	3.90	4.40	3.25	5.75	3.75	5.00	3.00	4.25
September	3.80	4.00	2.00	4.75	2.75	4.10	2.40	4.05
October	3.30	3.65	2.00	4.20	2.50	3.75	2.80	3.00
November	3.40	3.65	2.00	4.25	3.00	3.75	2.80	3.50
December	3.40	3.65	2.00	4.25	3.00	3.75	2.90	3.25
1903.	Per bushel.							
January	1.55	1.70	2.50	4.35	3.00	3.75	3.00	3.60
February	1.55	1.70	2.50	4.35	3.00	3.75	2.75	3.60
March	1.45	1.65	2.00	3.55	2.00	3.75	2.00	3.25
April	1.35	1.50	2.00	3.70	2.00	3.25	2.00	2.80
May	1.35	1.50	2.00	3.75	2.25	2.90	2.00	2.40
June	1.35	1.60	2.00	4.00	2.35	3.35	2.00	2.50
July	....	....	1.75	3.65	2.60	3.35	2.40	3.20
August	....	....	1.75	3.40	2.50	3.25	2.75	3.51
September	1.35	1.50	2.50	3.40	2.50	3.25	2.50	3.26
October	1.25	1.50	2.00	3.17½	2.30	3.00	2.48	3.20
November	1.25	1.40	2.00	3.00	2.25	2.85	2.20	2.85
December	1.20	1.40	2.00	3.05	2.25	2.75	2.25	2.85
1904.								
January	1.20	1.35	2.00	3.25	2.25	3.15	2.25	2.80
February	1.25	1.35	2.25	3.25	2.50	3.15	2.50	2.80
March	1.25	1.35	2.00	3.25	2.00	3.15	2.40	2.75
April	1.20	1.35	2.00	3.00	2.00	2.90	2.40	2.68
May	1.20	1.30	2.00	3.05	2.25	2.90	2.40	2.75
June	1.20	1.30	2.00	3.05	2.25	2.90	2.40	2.75
July	1.20	1.30	2.00	3.25	2.00	3.00	2.40	2.75
August	1.20	1.35	2.00	3.05	2.50	3.00	2.40	2.80
September	1.15	1.35	2.00	3.00	2.25	3.00	2.00	2.76
October	1.15	1.25	1.75	2.75	2.10	2.80	2.00	2.45
November	1.15	1.30	1.75	2.70	2.10	2.65	2.00	2.40
December	1.15	1.30	1.75	2.72½	2.25	2.65	2.00	2.40
1905.			(a)					
January	1.15	1.30	1.75	2.80	2.25	2.65	2.00	2.40
February	1.15	1.30	2.00	2.92½	2.25	2.65	2.00	2.50
March	1.15	1.30	2.25	3.10	2.25	2.90	2.00	2.50
April	1.15	1.30	2.00	3.10	2.50	2.90	2.00	2.75
May	1.20	1.30	2.00	3.10	2.50	2.90	2.00	2.50
June	1.20	1.30	2.00	3.00	2.25	2.90	2.00	2.50
July	1.20	1.30	2.50	3.30	2.25	2.95	2.40	2.75
August	1.20	1.45	2.00	3.60	2.35	3.50	2.40	3.70
September	1.40	1.60	2.00	3.75	2.70	3.40	3.00	3.70
October	1.35	1.55	2.00	3.40	2.40	3.50	2.50	3.10
November	1.35	1.40	1.50	3.50	2.50	3.10	2.50	2.80
December	1.30	1.35	1.50	3.50	2.50	3.10	2.50	2.80
1906.								
January	1.30	1.35	2.00	3.40	2.50	3.10	2.60	2.80
February	1.30	1.35	2.25	3.35	2.60	2.80	2.60	3.20
March	1.30	1.35	2.00	3.25	2.40	2.75	2.50	3.05
April	1.30	1.35	2.00	3.20	2.45	2.80	2.50	3.20
May	1.30	1.35	2.00	3.35	2.60	2.95	2.40	3.20
June	1.35	1.45	2.25	4.25	2.70	4.00	2.40	4.00
July	1.50	1.80	2.50	4.25	3.25	4.00	3.00	4.00
August	1.50	1.80	2.50	4.10	3.15	3.75	3.00	4.00
September	1.50	1.80	3.00	4.30	3.10	3.75	3.60	4.00
October	1.50	1.80	3.00	4.25	3.10	3.75	3.25	4.00
November	1.50	1.80	3.00	4.40	3.10	3.75	3.25	4.00
December	1.50	1.85	3.25	4.50	3.10	4.25	3.25	4.00

[a] Poor to prime.

FARM ANIMALS AND THEIR PRODUCTS.

[Figures furnished by the Bureau of Statistics, Department of Agriculture, except where otherwise credited. All prices on gold basis.]

Live stock of countries named.

[Africa incompletely represented, through lack of statistics for large areas. Number of animals in China, Persia, Afghanistan, Korea, Bolivia, Ecuador, Salvador, and several less important countries unknown. For Brazil number of cattle alone estimated, but roughly. In general, statistics of cattle, horses, sheep, and swine much more complete than those of other animals, as statements for the world.]

	Year.	Cattle.		Horses.	Mules.	Sheep.	Swine.
		Total.	Dairy cows.				
NORTH AMERICA.							
United States:							
Contiguous—							
On farms	1907	72,534,000	20,968,000	19,747,000	3,817,000	53,240,000	54,794,000
Not on farms	1900	1,616,422	973,033	2,936,881	173,908	231,301	1,818,114
Noncontiguous—							
Alaska [a]	1900	18	13	5	....	....	10
Hawaii [a]	1900	102,908	4,028	12,982	6,506	102,098	8,057
Porto Rico	1899	260,225	73,372	58,064	6,985	6,363	66,180
Total United States (except Philippine Islands)	......	74,513,573	22,018,446	22,755,532	4,004,399	53,579,762	56,686,361
Bermuda	1905	....	....	[b] 1,246	....	....	....
Canada:							
New Brunswick	1905	230,000	111,084	62,000	....	183,000	55,000
Ontario	1906	2,963,618	1,129,047	688,147	....	1,304,809	1,819,778
Manitoba	1906	521,112	170,143	215,819	....	28,975	200,509
Saskatchewan	1906	472,854	112,618	240,566	....	121,290	123,916
Alberta	1906	950,632	101,245	226,534	....	154,266	114,623
Other	1901	2,123,932	1,033,295	531,249	....	1,178,872	561,866
Total Canada	......	7,262,148	2,657,432	1,964,315	....	2,971,212	2,875,692
Central America:							
Guatemala	1898	196,768	....	50,343	....	77,593	29,784
Honduras	1904	569,812	....	43,107	14,064	11,806	111,581
Nicaragua	......	1,200,000	....	....	....	....	....
Panama	1906	156,569	....	30,863	1,500	....	28,000
Costa Rica	1905	308,160	[c] 93,155	54,974	2,987	250	79,730
Mexico	1902	5,142,457	....	859,217	334,435	3,424,430	616,139
Newfoundland	1901	32,767	....	8,851	....	78,052	34,679
West Indies:							
British—							
Barbados	1905	....	....	2,388	....	....	....
Dominica	1905	[d] 1,437	....	650	....	[d] 1,088	....
Grenada	1901	1,908	....	1,074	....	1,975	....
Jamaica	1905	111,703	....	72,847	....	16,976	28,590
Montserrat	1905	....	....	246	....	....	....
Turks and Caicos Islands	1905	800	....	105	....	125	....
Virgin Islands	1904	2,000	....	255	....	300	....
Cuba	[e] 1906	2,176,178	[f] 1,053,847	342,568	45,559	[g] 9,982	[g] 355,868
Dutch	1904	4,048	....	905	177	26,582	3,596
Guadeloupe	([h])	30,560	....	8,819	6,311	11,731	32,656
Total North America	......	91,710,888	....	26,198,305	4,409,432	60,211,864	60,885,586
SOUTH AMERICA.							
Argentina	1901	30,000,000	2,500,000	5,600,000	300,000	120,000,000	800,000
Brazil	......	30,000,000	....	....	....	....	....
British Guiana	1905	77,050	....	1,571	....	21,160	13,350
Chile	1906	2,477,064	[i] 124,657	698,880	[j] 27,936	2,405,584	287,612

[a] On farms.
[b] Including mules and asses.
[c] Cows in 1904.
[d] Data for 1903.
[e] On December 31 of preceding year.
[f] Cows.
[g] Census for 1899.
[h] Latest official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
[i] Data for 1904.
[j] Data for 1902.

Live stock of countries named—Continued.

	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
SOUTH AMERICA—cont'd.							
Colombia	......	2,800,000	....	341,000	257,000	746,000	2,300,000
Dutch Guiana	1904	8,290	....	209	74	153	2,879
Falkland Islands	1905	4,500	....	3,000	....	700,894	100
Paraguay	1900	2,283,039	....	182,789	3,490	214,058	23,887
Uruguay	1900	6,827,428	....	561,408	22,902	18,608,717	93,923
Venezuela	1899	2,004,257	....	191,079	89,186	176,668	1,618,214
Total South America	......	76,481,628	....	7,579,936	700,678	142,873,234	5,139,965
EUROPE.							
Austria-Hungary:							
Austria	1900	9,511,170	[a] 4,749,152	1,716,488	20,323	2,621,026	4,682,654
Hungary	1895	6,605,365	[b] 3,499,724	2,308,457	1,911	8,122,682	7,330,343
Bosnia-Herzegovina	1895	[c] 1,417,341	....	[d] 239,626	....	3,230,720	662,242
Total Austria-Hungary	......	17,533,876	....	4,264,571	22,234	13,974,428	12,675,239
Belgium	[e] 1906	1,788,328	889,125	245,212	[f] 6,915	[g] 235,722	1,046,519
Bulgaria	1905	[h] 1,596,267	[i] 442,866	536,616	11,828	8,081,816	463,241
Denmark	1903	1,840,466	[a] 1,089,073	486,935	....	876,830	1,456,699
Faroe Islands	1903	3,950	....	632	....	91,034	15
Finland	1904	1,450,914	[a] 1,066,251	315,535	....	936,333	215,910
France	[e] 1906	14,315,552	[a] 7,515,564	3,169,224	198,865	17,783,209	7,558,779
Germany	1904	19,331,568	[a] 10,456,137	4,267,403	....	7,907,173	18,920,666
Gibraltar	1905	....	....	400	....	....	....
Greece	1902	406,744	....	159,068	88,869	4,568,158	79,716
Iceland	1904	30,498	....	47,545	....	[j] 495,170	....
Italy	1900	[k] 5,000,000	....	741,739	327,276	[k] 6,900,000	[k] 1,800,000
Luxemburg	1901	92,381	....	19,777	[l] 10	16,611	91,799
Malta	1906	7,397	....	3,879	2,968	18,574	5,390
Montenegro	......	60,000	[a] 20,000	3,000	....	400,000	8,000
Netherlands	1904	1,690,463	[m] 973,098	295,277	....	606,785	861,840
Norway	1900	950,201	[a] 689,563	172,999	....	998,819	165,348
Portugal	......	817,000	....	90,000	59,100	3,064,100	1,200,000
Roumania	1900	2,545,051	380,720	864,324	515	5,655,444	1,709,205
Russia:							
Russia proper	1906	31,994,849	....	21,260,061	....	[n] 49,114,500	10,372,036
Poland	1906	2,414,618	....	1,309,640	....	[n] 2,817,000	800,470
Northern Caucasia	1906	3,157,358	....	1,265,100	....	[o] 6,957,954	698,335
Total Russia, European	1906	37,566,825	....	23,834,801	....	58,889,454	11,870,841
Servia	[e] 1906	943,967	[h] 153,359	172,278	130	3,066,444	875,517
Spain	1905	2,075,142	....	498,157	767,570	13,025,512	1,743,863
Sweden	1905	2,549,928	[a] 1,763,857	554,999	....	1,074,386	829,888
Switzerland	1906	1,497,904	[a] 785,577	135,091	3,136	209,243	548,355
Turkey	......	1,000,000	[a] 300,000	600,000	....	10,000,000	....
United Kingdom:							
Great Britain	1906	7,010,856	[p] 2,738,411	[q] 1,568,681	....	25,420,360	2,323,461
Ireland	1906	4,638,924	[p] 1,496,284	[q] 531,858	....	3,714,832	1,244,193
Isle of Man and Channel Islands	1906	42,175	[p] 17,591	[q] 9,485	....	74,843	13,086
Total United Kingdom	......	11,691,955	[p] 4,252,286	[q] 2,110,024	....	29,210,035	3,580,740
Total Europe	......	126,786,377	....	43,589,486	1,489,416	188,085,280	67,707,570

[a] Cows.
[b] Cows over 1 year old, including buffalo cows.
[c] Including buffaloes.
[d] Including mules and asses.
[e] On December 31 of preceding year.
[f] Including asses; data for 1895.
[g] Data for 1895.
[h] Census data, December 31, 1900.
[i] Cows, census data, December 31, 1900.
[j] Excluding lambs.
[k] Data for 1890.
[l] Including asses.
[m] Including cows kept for breeding purposes.
[n] Data for 1905.
[o] Including goats.
[p] Cows and heifers in milk and with calf.
[q] Used for agriculture, and also unbroken.

Live stock of countries named—Continued.

	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
ASIA.							
British India a	1905	b 88,920,714	c 26,052,025	1,433,458	54,787	d 21,266,729	....
Ceylon	1905	1,489,882	....	3,549	....	95,547	98,080
Cochin China	1903	109,000	....	11,243	....	....	709,400
Cyprus	1906	52,916	....	e 59,100	....	f 253,138	45,357
Hongkong	1905	976	....	193	....	3	....
Japanese Empire:							
Japan	g 1906	1,171,074	33,154	1,372,422	....	3,590	228,204
Formosa	g 1905	98,528	c 39,295	68	....	....	976,327
Total Japanese Empire	......	1,269,602	....	1,372,490	....	3,590	1,204,531
Java	1900	2,654,809	....	418,400	....	....	....
Labuan	1905	2,000	....	3	....	....	....
Philippine Islands	1903	127,559	....	144,171	290	30,428	1,179,371
Russia:							
Central Asia (4 provinces)	1906	1,813,653	....	1,900,391	....	i 9,113,000	87,842
Siberia (4 provinces)	1906	3,798,010	....	3,032,863	....	i 3,773,000	707,079
Transcaucasia	1902	2,304,977	....	388,936	....	6,302,258	309,479
Other	1903	2,343,000	....	1,624,000	....	5,44[illegible],000	186,400
Total Russia, Asiatic	......	10,259,640	....	6,955,190	....	24,631,258	1,350,800
Siam	......	1,104,751	....	35,812	....	....	....
Straits Settlements	1904	25,379	....	1,997	....	i 43,920	102,000
Turkey, Asiatic	......	3,000,000	....	800,000	....	45,000,000	....
Total Asia	......	109,017,228	....	11,235,666	55,077	91,324,613	4,[illegible]9,539
AFRICA.							
Algeria	1905	1,066,404	....	221,140	174,234	9,062,636	91,267
Basutoland	1904	213,361	....	64,621	j 26	j 2,794	j 476
British Central Africa	1906	29,203	....	14	18	11,566	3,427
British East Africa	1905	297,000	....	k 186	....	2,100,000	....
Cape of Good Hope	1904	1,954,390	540,310	255,060	64,433	11,818,829	385,945
Egypt	1899	350,000	....	80,000	10,000	....	....
German East Africa	1905	523,052	....	73	79	1,560,000	1,447
German Southwest Africa	1903	l 90,385	c 32,804	5,265	88	l 186,742	690
Madagascar m	1905	2,867,612	c 1,118,162	1,074	464	333,454	522,021
Mauritius n	1905	7,715	....	577	o 143	828	3,965
Mayotte	(p)	47,894	....	21	15	124	....
Natal	1905	783,887	c 252,496	54,637	2,578	769,601	66,852
Orange River Colony	1905	525,372	....	93,984	....	4,194,247	134,782
Reunion	(p)	4,720	....	1,780	4,534	4,583	....
St. Helena	1901	1,014	....	120	....	2,094	280
Seychelles	1905	1,000	....	150	....	200	6,000
Sierra Leone	1902	984	....	23	....	741	204
Southern Nigeria Colony (Lagos)	1902	1,522	....	108	....	1,610	2,426
Sudan (Anglo-Egyptian) q	1905	314,996	....	9,314	....	1,421,721	....
Transvaal	1905	800,000	350,000	r 32,159	r 44,153	1,200,000	400,000
Tunis	g 1905	183,748	....	35,596	15,995	1,094,761	15,357
Total Africa	......	10,064,259	....	875,902	316,760	33,766,531	1,635,139

a Including Native States, as far as officially shown. Statistics cover only six districts of Bengal, collected between 1890 and 1900.
b Including buffalo calves.
c Cows.
d Of which 373,003 in Alwar include goats.
e Including mules and asses.
f Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
g On December 31 of preceding year.
h Data for 1903.
i Including goats.
j Excluding animals owned by natives.
k Excluding the Province of Jubaland.
l Excluding the Windhuk district, in which the cattle were estimated at 1,774 and the sheep and goats at 2,030.
m Not including animals in the public service.
n On sugar estates only.
o Including asses; data for 1904.
p Latest official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
q Animals assessed for tribute and tax.
r Data for 1904.

Live stock of countries named—Continued.

	Year.	Cattle. Total.	Cattle. Dairy cows.	Horses.	Mules.	Sheep.	Swine.
OCEANIA.							
Australia:							
Queensland	a1906	2,963,695	....	430,565	....	12,535,231	164,087
New South Wales	a1906	2,337,973	644,164	506,884	....	39,506,764	310,702
Victoria	1905	1,737,690	649,100	385,513	....	11,455,115	273,682
South Australia	1906	647,631	b 93,069	216,345	....	6,202,330	119,00[illegible]
Western Australia	a1906	631,825	c 27,724	97,397	d 840	3,120,603	74,567
Tasmania	1906	206,211	....	37,101	....	1,583,561	72,810
Total Australian Commonwealth	......	8,525,025	....	1,673,805	840	74,403,604	1,014,853
British New Guinea	1905	400	....	70	....	....	....
Fiji	1905	28,635	....	3,758	....	1,417	2,778
New Caledonia	(e)	73,862	....	2,938	12	9,442	2,438
New Zealand f	1905	1,810,936	574,794	326,537	g 429	19,130,875	249,727
Total Oceania	......	10,438,858	....	2,007,108	1,281	93,545,338	1,269,796
Grand total	......	424,499,238	....	91,486,403	6,972,644	609,806,860	141,327,595

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
NORTH AMERICA.						
United States:						
Contiguous—						
On farms	1900	94,165	....	....	1,870,599	....
Not on farms	1900	15,847	....	....	78,353	....
Noncontiguous—						
Hawaii h	1900	1,438	....	....	653	....
Porto Rico h	1899	1,085	....	....	15,991	....
Total United States (except Philippine Islands)	......	112,535	....	....	1,965,596	....
Central America:						
Costa Rica	1905	100	....	....	906	....
Panama	1905	47	....	....	1,989	....
Mexico	1902	287,991	....	....	4,206,011	....
Newfoundland	1901	....	....	....	17,355	....
West Indies:						
British—Jamaica	1904	....	....	....	14,000	....
Cuba	a1906	2,530	....	....	i 18,564	....
Dutch	1904	5,377	....	....	57,869	....
Guadeloupe	(e)	4,394	....	....	13,902	....
Total North America	......	412,974	....	....	6,296,192	....
SOUTH AMERICA.						
Argentina	1901	200,000	....	....	3,100,000	....
British Guiana	1905	....	....	....	17,700	....
Chile	1906	j 17,574	....	....	461,908	....
Colombia	....	....	....	....	361,000	....
Dutch Guiana	1904	505	....	....	1,597	....
Paraguay	1900	4,067	....	....	32,334	....
Uruguay	1900	....	....	....	20,428	....
Venezuela	1899	312,810	....	....	1,667,272	....
Total South America	......	534,956	....	....	5,662,239	....
EUROPE.						
Austria-Hungary:						
Austria	1900	46,324		....	1,019,664	....
Hungary	1895	23,855	133,000	....	308,810	....
Bosnia-Herzegovina	1895	....	....	....	1,447,049	....
Total Austria-Hungary	......	70,179	133,000	....	2,775,523	....

a On December 31 of preceding year.
b Not including northern territory.
c Data for 1905.
d Including asses; data for 1905.
e Latest official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
f Including animals owned by Maoris.
g Including asses.
h On farms.
i Census for 1899.
j Data for 1902.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
EUROPE—continued.						
Belgium	[a]1905				257,669	
Bulgaria	1905	124,216	[b]431,487		1,370,201	
Denmark	1903				38,984	
Faroe Islands	1903				10	
Finland	1904				6,499	140,104
France	[a]1906	365,181			1,476,957	
Germany	1904				3,329,881	
Greece	1902	141,179			3,339,409	
Iceland	1904				401	
Italy	1890	1,000,000			1,800,000	
Luxemburg	1901				14,203	
Malta	1906	3,818			20,083	
Montenegro					100,000	
Netherlands	1904				165,497	
Norway	1900				214,594	108,784
Portugal		146,500			998,680	
Roumania	1900	7,186	43,475		232,515	
Russia:						
Russia proper	1905			224,500	1,100,500	347,000
Poland	1905			1,000	13,500	
Total Russia, European	1905			225,500	1,114,000	347,000
Servia	[a]1906	1,271	7,710		495,955	
Spain	1905	663,004		1,800	2,385,664	
Sweden	1905				66,560	
Switzerland	1906	1,652			359,913	
Total Europe		2,524,186	615,672	227,300	20,563,198	595,888
ASIA.						
British India [c]	1905	[d]1,329,057	14,849,189	424,747	28,287,635	
Ceylon	1904				153,542	
Cochin China	1903		241,750			
Cyprus	1905			1,157	[e]250,306	
Hongkong	1904				164	
Japanese Empire:						
Japan	[a]1906				72,121	
Formosa	[a]1905		226,620		117,214	
Total Japanese Empire			226,620		189,335	
Java	1900		2,436,031			
Philippine Islands	1903		[f]640,871		124,334	
Russia:						
Central Asia (4 provinces)	1903			365,000	775,000	
Siberia (4 provinces)	1903			500	230,000	38,700
Transcaucasia	1902	122,312	338,042	17,122	745,086	
Other	1903	58,500		296,000	802,000	20,000
Total Russia, Asiatic		180,812	338,042	678,622	2,552,086	58,700
Siam [g]			1,144,478			
Turkey, Asiatic		2,500,000			9,000,000	
Total Asia		4,009,869	19,876,981	1,104,526	40,557,402	58,700
AFRICA.						
Algeria	1905	277,523		199,715	4,030,208	
Basutoland	1904	[h]10			[h]1,625	
British Central Africa	1906	86	12		30,238	
British East Africa	1905				1,150,000	
Cape of Good Hope	1904	100,470			7,162,463	
Egypt	1900	120,000	300,000	40,000		
German East Africa	1905	8,777		24	1,820,000	
German Southwest Africa	1903	899		3	[i]160,118	
Madagascar [j]	1905	411			66,747	
Mauritius [k]	1904				5,223	

[a] On December 31 of preceding year.
[b] Census data, December 31, 1900.
[c] Including Native States, as far as officially shown. Statistics cover only six districts of Bengal, collected between 1890 and 1900.
[d] Of which, 62,652 in Bengal, Alwar, Gwalior, and Marwar include mules.
[e] Not less than 1 year old; 30 per cent may be added for those less than 1 year old.
[f] Carabaos.
[g] Number of domesticated elephants returned as 2,036.
[h] Excluding animals owned by natives.
[i] Excluding the Windhuk district, in which the cattle were estimated at 1,774 and the sheep and goats at 2,630.
[j] Not including animals in the public service.
[k] On sugar estates only.

Live stock of countries named—Continued.

Country.	Year.	Asses.	Buffaloes.	Camels.	Goats.	Reindeer.
AFRICA—continued.						
Mayotte	(a)	58			1,508	
Natal	1905	1,792			908,791	
Orange River Colony	1903	3,096			308,920	
Reunion	(a)	1,916			4,156	
St. Helena	1901	774			1,001	
Southern Nigeria Colony (Lagos)	1902				2,600	
Sudan (Anglo-Egyptian)[b]	1905	[c] 92,272		132,116	1,329,711	
Transvaal	1904	33,013		949,876		
Tunis	[e]1905	97,990		147,229	574,281	
Total Africa		739,087	300,012	1,468,963	17,557,590	
OCEANIA.						
Australia:						
New South Wales	[d]1905			853	37,716	
South Australia	1905				26,948	
Western Australia	[d]1905			1,953	17,980	
Tasmania	1905				1,694	
Total Australian Commonwealth				2,806	84,338	
Fiji	1904				15,361	
New Caledonia	(a)				6,111	
New Zealand [e]	1891				9,055	
Total Oceania				2,806	114,865	
Grand total		8,221,072	20,792,665	2,803,595	90,751,486	654,588

[a] Latest official estimate furnished by the French embassy to the United States, under date of May 4, 1906.
[b] Animals assessed for tribute and tax.
[c] Including mules.
[d] On December 31 of preceding year.
[e] Including animals owned by Maoris.

INTERNATIONAL TRADE IN ANIMAL PRODUCTS.

MEAT.

Value of imports of meat animals and packing-house products into thirteen European countries and Cuba in 1904, and percentages derived from the United States.

Importing country.	Total of three following columns.	Live meat animals.	Packing-house products.	Poultry, game, rabbits, pigeons, etc.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*
Imported from all countries by—				
United Kingdom	283,158,215	50,263,256	223,171,623	9,723,336
Germany [a] (for consumption)	83,600,900	28,558,800	43,472,200	11,569,900
Netherlands (for consumption)	28,609,594	253,266	28,280,364	75,964
France (for consumption)	19,675,069	7,008,413	9,842,335	2,824,321
Belgium (for consumption)	15,938,990	5,739,069	9,698,218	501,703
Switzerland (for consumption)	15,881,517	10,352,595	3,864,307	1,664,615
Austria-Hungary (for consumption)	13,685,042	7,819,808	4,712,938	1,152,296
Cuba	13,011,989	6,639,536	6,368,058	4,395
Denmark (for consumption)	5,507,000	304,100	5,135,300	67,600
Spain	7,944,076	3,264,763	4,028,803	650,510
Italy (for consumption)	6,959,073	1,244,792	5,646,532	67,749
Russia (for consumption) (1903)	4,784,578	2,266,604	2,461,257	56,717
Norway	4,099,100	468,100	3,577,500	53,500
Sweden (1903)	3,860,369	130,646	3,637,540	92,183
Total	506,715,512	124,313,748	353,896,975	28,504,789

Value of imports of meat animals and packing-house products into thirteen European countries and Cuba in 1904, and percentages derived from the United States—Con.

Importing country.	Total of three following columns.	Live meat animals.	Packing-house products.	Poultry, game, rabbits, pigeons, etc.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*
Imported from the United States by—				
United Kingdom	135,386,887	37,066,568	97,247,674	1,072,645
Germany [a] (for consumption)	25,207,400		25,206,000	1,400
Netherlands (for consumption)	16,236,441		16,236,433	8
France (for consumption)	(b)	(b)	(b)	(b)
Belgium (for consumption)	5,908,315	970,086	4,938,229	(b)
Switzerland (for consumption)	657,930		657,888	42
Austria-Hungary (for consumption)	1,683,826		1,683,826	
Cuba	6,187,668	1,919,460	4,264,011	4,197
Denmark (for consumption)	(b)	(b)	(b)	(b)
Spain	486,757	22	486,732	3
Italy (for consumption)	1,764,965		1,764,965	
Russia (for consumption) (1903)	122,268		122,268	
Norway	821,000		821,000	(b)
Sweden (1903)				
Total	194,463,457	39,956,136	153,429,026	1,078,295
	Percentage from the United States.			
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
United Kingdom	47.81	73.74	43.58	11.03
Germany [a]	30.15		57.98	
Netherlands	56.75		57.41	
France	(b)	(b)	(b)	(b)
Belgium	37.07	16.90	50.92	(b)
Switzerland	4.14		17.02	
Austria-Hungary	12.30		35.73	
Cuba	47.55	28.91	66.96	95.49
Denmark	(b)	(b)	(b)	(b)
Spain	6.13		12.08	
Italy	25.36		31.26	
Russia (1903)	2.56		4.97	
Norway	20.03		22.95	(b)
Sweden (1903)				
Total	[c] 40.38	[c] 34.15	[c] 45.27	[d] 4.30

[a] Not including free ports.
[b] Not stated.
[c] Omitting France and Denmark.
[d] Omitting France, Belgium, Denmark, and Norway.

WOOL.

International trade in wool,[a] 1901–1906.[b]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Algeria	Jan. 1	7,042,341	9,634,557	16,689,429	21,519,315	22,422,990
Argentina	Jan. 1	503,443,071	436,374,060	425,467,795	371,697,065	421,098,234
Australia	Jan. 1	451,560,039	335,953,936	324,563,030	395,130,825	437,167,965
Belgium	Jan. 1	38,245,719	48,566,645	51,456,971	46,947,529	45,433,183
British India	Apr. 1	19,651,756	28,038,050	33,326,503	38,602,768	42,723,826
Cape of Good Hope	Jan. 1	76,022,938	96,957,471	79,698,393	78,411,050	74,311,616
France	Jan. 1	103,001,990	138,081,466	117,425,271	130,119,445	116,405,477
Netherlands	Jan. 1	34,060,782	36,231,009	42,214,830	33,032,572	31,837,603
New Zealand	Jan. 1	146,820,079	160,419,023	155,128,381	126,834,850	139,912,737
Peru	Jan. 1	8,608,928	8,182,423	9,257,920	7,952,000	9,944,067
Russia	Jan. 1	23,757,528	29,354,903	30,071,056	35,298,276	[c]31,851,490
Spain	Jan. 1	20,459,512	25,835,165	25,096,103	28,808,285	[c]25,096,103
Turkey[d]	Mar. 1	40,621,737	40,621,737	40,621,737	40,621,737	40,621,737
United Kingdom	Jan. 1	20,205,000	37,204,800	35,950,200	37,858,500	35,251,500
Uruguay	Jan. 1	101,867,309	95,637,488	92,124,262	99,148,465	[e]97,194,381
Other countries		126,423,000	160,652,000	179,655,000	193,824,000	170,398,000
Total		1,721,791,729	1,687,744,733	1,658,746,881	1,685,806,682	1,741,670,909

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Austria-Hungary	Jan. 1	72,179,986	85,970,337	79,549,817	83,296,792	79,440,467
Belgium	Jan. 1	118,479,056	122,180,634	119,472,000	117,205,945	140,786,550
British India	Apr. 1	9,784,739	7,452,021	7,431,310	8,807,926	13,741,761
Canada	July 1	10,360,738	7,994,702	7,339,369	7,617,211	6,311,837
France	Jan. 1	547,568,307	519,152,812	523,823,309	465,475,496	479,886,724
Germany[f]	Jan. 1	370,476,806	416,038,627	425,726,618	413,781,976	422,380,883
Japan	Jan. 1	6,652,876	5,505,283	7,282,080	21,281,995	14,085,397
Netherlands	Jan. 1	43,732,352	45,481,019	49,996,876	42,618,842	37,692,892
Russia	Jan. 1	58,087,872	65,114,737	71,607,060	50,207,084	[c]41,601,946
Sweden	Jan. 1	8,499,894	9,809,111	10,164,381	10,471,454	10,349,336
Switzerland	Jan. 1	12,462,949	13,305,114	13,465,390	14,139,564	12,951,713
United Kingdom	Jan. 1	421,520,875	392,752,036	351,928,151	344,758,631	371,364,280
United States	July 1	166,576,966	177,137,796	173,742,834	249,135,746	201,688,668
Other countries		53,000,000	58,692,000	63,556,000	60,020,000	26,156,000
Total		1,899,383,416	1,926,586,229	1,905,085,195	1,888,818,662	1,858,438,454

[a] Including wool combed, carded, and dyed.
[b] See "General note," p. 546.
[c] Preliminary figures.
[d] Exports for 1899, the latest available data.
[e] Average, 1901–1904.
[f] Not including free ports.

*International trade in hides and skins.**

[Substantially the international trade of the world. This table gives the classifications as found in the original returns, and the summary statements for "All countries" represent the total for each class only as far as it is disclosed in the original returns.]

EXPORTS.

Country.	Year beginning—	Kind of hides and skins.	1901.	1902.	1903.	1904.	1905.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	Cattle, dried	58,746,562	58,550,351	51,239,825	50,466,002	53,457,674
		do., salted	62,077,746	77,917,955	63,424,770	64,809,273	90,239,588
		Goat	2,909,164	3,025,215	3,113,899	3,961,693	4,205,350
		Horse, dried	2,793,673	4,354,053	2,870,826	2,152,791	2,801,828
		do., salted	6,036,299	4,187,878	4,921,984	4,591,961	1,731,726
		Kid	1,118,824	1,075,505	815,695	1,049,508	971,729
		Sheep	90,654,057	91,282,374	92,442,005	81,571,014	66,535,492
Austria-Hungary	Jan. 1	Calf, dried	7,807,889	8,363,895	6,681,327	6,139,211	6,855,933
		do., salted	1,272,287	3,299,437	5,505,382	6,623,787	9,100,680
		Cattle, dried	5,751,638	7,717,941	6,801,038	6,274,354	5,676,240
		do., salted	7,674,951	10,025,959	12,569,873	9,172,109	13,682,766
		Goat	1,972,034	2,079,840	2,004,442	2,542,591	1,977,987
		Horse, dried	1,606,508	1,802,940	1,313,514	1,033,747	2,297,437
		do., salted	530,432	869,062	2,162,293	2,495,853	3,808,485
		Kid	1,205,708	1,362,015	1,431,241	2,120,626	1,836,009
		Lamb	4,680,413	5,084,079	4,232,874	3,187,442	3,535,111
		Sheep	1,763,698	3,073,243	4,034,017	3,575,676	4,251,393
Belgium	Jan. 1	Hides and skins	97,902,746	90,233,439	91,087,316	90,367,454	101,081,934
Brazil	Jan. 1	Deer	266,636	339,935	265,401	262,167	176,295
		Goat	2,541,682	3,271,247	4,193,246	5,556,633	3,362,049
		Hides, dried, n. e. s.[a]	13,786,654	14,334,210	16,401,080	23,845,672	17,394,410
		do., salted, n. e. s.	35,280,733	44,873,097	46,006,347	48,004,782	42,135,260
		Horse	(b)	(b)	88,194	245,716	28,936
		Lamb	32,377	33,881	67,298	289,196	5,143
		Sheep	483,011	615,134	598,573	1,042,429	954,612
		Other	156,010	8,426	9,262	28,911	33,113
British India	Apr. 1	Hides and skins	106,457,402	102,390,604	104,922,115	120,635,178	166,742,490
Canada [c]	July 1	Hides and skins	20,673,000	23,096,000	23,647,000	29,418,000	31,760,000
Cape of Good Hope	Jan. 1	Calf	30,044	13,710	69,317	90,391	96,562
		Cattle	2,390,894	2,587,990	1,189,172	2,049,386	2,970,438
		Goat	3,752,060	4,491,204	5,217,449	4,928,951	5,461,295
		Hides, n. e. s.	27,498	13,940	8,545	637	....
		Sheep	15,107,511	14,204,556	12,602,310	11,602,058	11,713,890
China	Jan. 1	Hides	31,267,867	39,360,667	32,309,600	37,330,133	25,259,467
Cuba	Jan. 1	Cattle	2,270,827	3,605,188	2,351,012	2,438,844	[d] 2,666,468
		Other	....	10,453	84,032	52,482	[e] 48,989
Denmark	Jan. 1	Hides and skins	14,255,086	14,895,515	15,520,748	16,166,351	19,345,629
Dutch East Indies	Jan. 1	Hides and skins	13,899,637	13,530,863	13,729,290	13,940,625	14,039,571

Egypt	Jan. 1	Cattle and calf	c 5,000,000	4,337,137	4,331,513	6,841,357	4,547,315
		Sheep and goat	c 800,000	f 681,118	f 697,529	f 1,084,797	f 2,620,849
France	Jan. 1	Calf	(b)	(b)	(b)	21,348,790	17,430,187
		Goat	(b)	(b)	(b)	7,613,556	10,333,449
		Kid	760,653	1,014,770	1,198,100	875,640	626,944
		Lamb	1,408,233	903,981	1,146,708	1,096,486	1,446,190
		Large	61,829,160	61,585,683	48,863,350	53,056,971	61,880,962
		Sheep	6,633,990	9,624,630	8,517,409	9,047,394	10,009,143
		Other	25,903,279	27,552,511	27,052,872	3,035,932	7,776,412
Germany g	Jan. 1	Calf, green	11,072,273	10,596,516	9,076,870	8,618,308	10,235,619
		do., dried	10,697,928	11,096,965	7,410,396	9,228,989	9,504,125
		Cattle, green	71,351,268	73,594,692	65,404,300	65,279,298	65,859,114
		do., dried	11,230,030	10,403,684	9,406,240	9,416,161	11,561,258
		Goat, with hair on	4,645,359	3,516,593	3,350,364	4,021,451	3,744,110
		do., without hair	65,918	11,023	12,566	15,432	19,401
		Horse, green	6,532,261	9,690,416	10,715,124	8,345,156	16,149,958
		do., dried	984,584	1,488,561	1,711,448	1,782,878	1,629,216
		Sheep	647,718	585,548	811,521	385,147	823,206
		Other	847,236	711,432	607,814	698,865	3,527
Italy	Jan. 1	Cattle and calf	22,774,627	20,757,839	24,070,283	23,639,941	19,357,463
		Sheep and goat	3,971,627	4,583,409	4,329,437	4,125,950	4,616,038
		Other	783,743	571,658	765,665	695,338	2,737,700
Korea	Jan. 1	Cattle	3,500,400	3,981,600	5,525,600	4,755,600	2,273,200
		Skins	2,810,267	3,954,667	5,421,200	4,660,533	5,507,867
Mexico	July 1	Alligator	498,130	343,013	263,545	176,853	131,074
		Cattle	12,855,391	14,808,550	11,692,993	13,122,915	15,690,473
		Deer	708,821	723,398	627,292	583,367	636,765
		Goat	5,859,231	6,518,637	5,798,853	5,934,593	7,098,634
		Horse	36,253	41,213	35,020	28,418	50,243
		Sheep	1,682	2,273	2,657	1,466	16,885
Netherlands	Jan. 1	Hides, dried	19,374,915	20,012,580	20,607,052	23,647,466	22,724,931
		do., fresh	198,478	271,541	414,482	301,548	236,435
		do., salted	29,958,414	32,387,467	33,893,118	31,865,968	32,383,298
		Sheep	1,563,428	3,227,362	2,309,591	2,708,125	1,664,492
New Zealand	Jan. 1	Calf f	10,014	50,152	23,136	29,862	103,286
		Hides f	909,625	855,722	1,013,593	1,041,637	1,926,201
		Sheep	10,067,447	13,795,190	15,074,406	12,833,612	12,599,222
Peru	Jan. 1	Hides and skins	4,968,320	5,324,480	6,009,920	6,717,760	d 5,755,120
Russia	Jan. 1	Hides, large	8,642,551	9,601,743	12,774,759	16,666,202	h 13,903,000
		do., small	15,449,236	19,764,247	19,949,000	24,406,908	h 24,484,000
		Sheep and goat	14,039,645	15,289,329	17,884,900	22,220,675	h 19,031,000
Singapore	Jan. 1	Hides	6,850,533	6,216,267	8,694,400	6,919,733	d 7,170,233
Spain	Jan. 1	Goat	3,901,634	3,158,648	2,628,269	2,014,515	1,629,152
		Sheep	4,253,300	5,714,217	5,210,152	6,305,843	8,384,034
		Other	3,904,293	2,355,431	4,248,659	5,965,921	9,335,375

* See "General note," p. 546.
a N. e. s.=not elsewhere specified.
b Not separately stated.
c Estimated.
d Average, 1901-1904.
e Average, 1902-1904.
f Number of pounds computed from stated number of hides or skins.
g Not including free ports.
h Preliminary.

International trade in hides and skins—Continued.

EXPORTS—Continued.

Country.	Year beginning	Kind of hides and skins.	1901.	1902.	1903.	1904.	1905.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Sweden	Jan. 1	Hides and skins	11,018,359	11,427,951	13,025,348	12,647,729	15,709,468
Switzerland	Jan. 1	Hides	13,675,711	12,836,632	12,201,200	11,750,194	12,095,438
		Skins	4,699,813	4,976,493	5,041,530	5,544,404	6,062,490
United Kingdom	Jan. 1	Hides	19,150,861	21,075,264	17,451,168	21,128,464	29,427,328
		Skins a	28,018,140	32,681,620	44,795,145	49,864,593	46,964,937
United States	July 1	Hides and skins	9,372,747	12,859,549	32,727,643	10,268,722	10,752,827
Uruguay	July 1	Calf	204,893	208,372	296,799	b 236,688	b 236,688
		Cattle, dried	1,279,316	2,044,988	3,272,490	b 2,198,931	b 2,198,931
		do., salted a	29,013,285	39,266,008	33,050,082	b 33,776,458	b 33,776,458
		Goat	78	1,277	1,414	b 923	b 923
		Horse, dried a	123,675	483,696	397,568	b 334,980	b 334,980
		do., salted a	1,137,188	1,946,505	1,751,352	b 1,611,682	b 1,611,682
		Lamb	368,282	358,738	608,383	b 445,134	b 445,134
		Sheep	16,411,764	14,670,701	19,397,852	b 16,826,606	b 16,826,606
Venezuela	July 1	Cattle	c 6,356,726	4,346,829	8,366,624	c 6,356,726	7,925,493
		Deer		100,654			349,459
		Goat	c 1,531,383	1,412,091	1,650,675	c 1,531,383	1,479,815
		Sheep		28,997			
Other countries		Hides:					
		Cattle	20,838,596	16,437,548	17,486,222	12,706,880	d 7,332,532
		Horse	81,961	33,486	80,026	348,784	535,340
		Large (not otherwise classified)		1,611,336	3,148,588	6,198,614	c 3,652,846
		Small (not otherwise classified)		501,523	1,352,037	1,915,667	c 1,256,409
		Unclassified	14,266,058	14,424,497	14,085,945	8,906,979	d 8,852,934
		Skins:					
		Calf	2,156,641	2,392,438	1,799,084	2,183,255	2,422,626
		Deer	1,852,402	1,745,289	1,303,750	1,372,926	d 859,467
		Goat	3,000,175	3,948,481	6,536,130	4,427,066	d 2,580,171
		Kid		66,932	21,786	40,836	40,889
		Sheep	6,887,384	3,173,604	3,313,301	2,942,913	10,149,837
		Sheep and goat, mixed	8,302,868	7,500,393	6,048,093	8,084,693	d 6,405,188
		Unclassified	112,548	147,072	73,145	66,311	f 99,769
		Hides and skins, unclassified	3,436,903	5,471,773	6,441,858	5,393,110	d 1,721,314
Total			1,220,912,368	1,295,874,343	1,301,239,716	1,322,348,651	1,406,297,064

All countries		**Hides:**					
		Cattle	295,397,690	325,285,683	291,780,241	282,822,937	315,310,633
		Cattle and calf, mixed	27,774,627	25,094,976	28,401,796	30,481,298	23,904,778
		Horse	19,922,834	24,897,810	26,047,349	22,971,966	30,979,831
		Large (not otherwise classified)	70,471,711	72,798,762	64,786,097	75,931,787	79,436,808
		Small (not otherwise classified)	15,449,236	20,265,770	21,301,037	26,322,575	25,740,409
		Unclassified	134,747,350	206,661,884	203,086,590	214,743,213	199,605,935
		Skins:					
		Alligator	498,130	343,013	263,545	176,853	131,074
		Calf	33,251,909	36,021,485	30,862,311	54,499,281	55,985,706
		Deer	2,827,859	2,909,276	2,196,443	2,218,460	2,021,986
		Goat	30,178,718	31,434,259	34,507,307	42,548,787	41,892,336
		Kid	3,094,185	3,519,222	3,466,822	3,210,970	3,475,571
		Lamb	6,489,310	6,380,679	6,055,263	5,893,907	5,431,578
		Sheep	154,474,990	159,997,338	164,313,794	148,842,283	144,228,812
		Sheep and goat, mixed	27,114,140	28,054,249	28,959,959	35,516,115	32,673,075
		Unclassified	35,640,768	41,759,852	55,331,020	60,135,841	58,635,063
		Hides and skins, unclassified	313,578,851	310,450,085	339,879,542	316,032,378	386,843,409
Total			1,220,912,368	1,295,874,343	1,301,239,716	1,322,348,651	1,406,297,064

IMPORTS.

Austria-Hungary	Jan. 1	Calf, dried	872,148	942,035	1,245,171	1,496,718	1,056,896
		do., green	1,323,655	1,066,155	1,716,078	1,449,759	994,505
		Cattle, dried	25,162,012	22,938,651	22,300,192	29,398,855	25,180,311
		do., green	15,093,114	18,459,961	18,503,392	27,347,454	17,540,414
		Goat	1,045,652	1,027,354	1,100,547	1,588,430	1,410,076
		Horse, dried	529,109	679,685	583,784	500,856	360,676
		do., green	173,945	75,178	125,223	153,662	224,871
		Kid	809,758	776,688	844,591	1,046,093	723,557
		Lamb	10,299,994	9,869,872	9,627,600	10,328,434	8,602,435
		Sheep	5,336,949	5,477,163	5,391,403	5,041,309	5,061,592
Belgium	Jan. 1	Hides, raw	104,969,717	115,127,382	128,694,622	122,539,211	135,911,437
British India	Apr. 1	Hides and skins	10,969,280	10,407,488	12,729,808	12,456,304	12,947,200
Denmark	Jan. 1	Hides and skins	7,325,959	8,013,801	5,766,189	6,962,196	7,848,454
Finland	Jan. 1	Hides, dried	1,302,976	714,805	1,560,180	1,869,515	1,898,433
		do., green	4,120,533	3,789,873	5,907,507	5,780,115	4,263,421
		Sheep	75,045	23,420	45,380	89,521	56,061
France	Jan. 1	Calf	(g)	(g)	(g)	7,090,953	7,980,756
		Goat	(g)	(g)	(g)	17,899,172	23,110,243
		Kid	5,017,437	5,300,740	4,714,701	4,372,843	4,544,123
		Lamb	252,681	212,442	441,758	370,533	378,553
		Large	71,059,171	80,509,184	89,049,162	85,214,088	98,515,340
		Sheep	1,623,988	3,848,128	3,032,612	2,630,226	2,532,200
		Other	27,056,709	28,625,723	28,990,427	2,063,720	3,209,189

[a] Number of pounds computed from stated number of hides or skins.
[b] Average, 1901-1903.
[c] Average, 1902 and 1903.
[d] Preliminary.
[e] Average, 1902-1904.
[f] Average, 1901-1904.
[g] Not separately stated.

International trade in hides and skins—Continued.

IMPORTS—Continued.

Country.	Year beginning	Kind of hides and skins.	1901.	1902.	1903.	1904.	1905.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Germany a	Jan. 1	Calf, dried	22,310,775	23,886,198	18,793,521	21,104,405	22,145,869
		do., green	10,145,891	16,023,193	22,039,386	24,738,945	32,244,140
		Cattle, dried	54,183,215	46,048,822	60,664,363	63,954,541	70,228,234
		do., green	113,322,201	122,198,450	146,242,719	152,057,850	143,851,586
		Goat, with hair on	6,714,617	8,591,191	9,266,908	11,272,453	11,042,952
		do., without hair	61,509	153,001	25,791	61,068	38,140
		Horse, dried	3,795,257	3,721,181	4,427,101	4,666,964	4,592,889
		do., green	27,309,091	28,144,866	30,128,805	27,629,866	25,891,742
		Sheep	500,449	562,840	737,005	1,126,562	746,485
		Other	2,044,126	2,207,268	3,032,017	3,515,711	2,240,443
Greece	Jan. 1	Hides	5,729,797	5,565,407	5,674,975	7,004,650	6,052,987
Italy	Jan. 1	Cattle and calf	33,458,225	33,054,118	32,555,653	42,876,591	39,240,949
		Sheep and goat	10,462,034	9,236,484	9,197,903	9,997,520	8,433,781
		Other	143,741	287,703	136,687	89,287	181,881
Japan	Jan. 1	Cattle	4,423,525	4,395,787	4,516,054	9,871,720	7,402,198
		Deer	481,482	353,188	437,982	373,908	426,217
Netherlands	Jan. 1	Hides, dried	28,644,748	26,123,959	28,746,002	28,190,550	29,700,509
		do., fresh	4,993	14,218	3,486	1,080	15,141
		do., salted	20,118,252	21,767,787	24,734,682	25,207,165	21,586,003
		Sheep	3,559,062	2,578,768	1,631,356	2,084,239	2,367,808
Norway	Jan. 1	Hides and skins	6,586,306	5,880,102	5,555,934	6,890,458	8,714,033
Portugal	Jan. 1	Hides, dried	6,553,065	6,659,709	6,188,733	5,829,003	4,216,287
		do., green	855,045	1,455,366	507,616	243,906	181,630
		do., n. e. s.	776	2,222	990	825	414
Roumania	Jan. 1	Buffalo	98,827	422,935	160,214	39,361	83,987
		Calf	35,003	29,674	65,731	13,406	13,728
		Cattle	3,667,133	5,045,606	3,468,799	2,444,346	2,552,952
		Horse	3,946	2,491	8,014	22	3,490
		Sheep, lamb, and goat	231,503	722,428	610,125	400,000	157,536
		Other	1,088,878	820,025	158,376	163,773	132,811
Russia	Jan. 1	Hides	16,307,457	12,831,961	12,279,363	10,412,368	b 8,523,000
		do., green	47,142,155	52,627,183	55,754,913	48,126,842	b 51,280,000
Singapore	Jan. 1	Hides	8,552,533	10,275,333	10,258,000	10,554,133	c 9,910,000
Spain	Jan. 1	Hides and skins	22,570,349	25,794,130	22,716,150	17,857,559	14,249,715
Sweden	Jan. 1	Hides and skins	12,859,717	15,676,710	15,172,306	19,782,796	18,939,762
United Kingdom	Jan. 1	Goat d	7,857,933	3,546,428	3,557,151	5,517,464	3,759,696
		Hides	83,375,936	73,656,912	62,491,856	61,636,848	60,628,848
		Sheep d	33,790,507	44,636,946	44,909,414	34,490,368	34,694,106
		Other		1,054,534	3,124,408	1,386,550	255,622
United States	July 1	Cattle	148,627,907	131,640,325	85,370,168	113,177,357	156,155,300
		Goat	88,038,516	85,114,070	86,338,547	97,803,571	111,079,391
		Other	89,457,680	102,340,303	103,024,752	126,893,934	158,045,419

Other countries	Hides:					
	Cattle	4,855,319	5,100,292	5,441,221	7,289,141	5,628,958
	Large (not otherwise classified)	10,654	412,785	438,504	1,054,916	716,282
	Small (not otherwise classified)	7,639	1,499	7,011	17,289	[b] 8,360
	Unclassified	4,883,760	5,590,463	8,100,685	4,932,465	[b] 5,365,853
	Skins:					
	Calf	159,714	135,079	13,933	153,261	252,319
	Deer	6,640	5,670	9,886	21,014	7,871
	Goat	256,375	142,253	423,808	452,838	[b] 236,286
	Sheep	495,767	397,783	1,533,850	1,534,647	1,128,969
	Sheep and goat, mixed	26,901	25,854	22,447	10,416	10,364
	Unclassified	1,110,468	1,249,139	1,348,347	1,277,800	1,474,231
	Hides and skins, unclassified	1,399,235	2,365,315	3,330,259	1,321,133	[b] 224,045
Total		1,232,665,469	1,268,461,682	1,287,754,237	1,365,305,461	1,452,511,962
All countries	Hides:					
	Buffalo	98,827	422,935	160,214	39,361	83,987
	Cattle	369,244,426	355,827,894	346,506,908	405,541,264	428,539,953
	Cattle and calf, mixed	33,458,225	33,054,118	32,555,653	42,876,591	39,240,949
	Horse	31,811,351	32,623,401	35,272,927	33,011,370	31,073,668
	Large (not otherwise classified)	71,069,825	80,921,969	89,487,666	86,269,604	99,231,622
	Small (not otherwise classified)	7,639	1,499	7,011	17,289	8,360
	Unclassified	332,561,743	336,202,580	350,903,610	332,328,685	335,135,632
	Skins:					
	Calf	34,847,186	42,082,334	43,873,820	56,047,447	64,688,213
	Deer	488,122	358,858	447,868	394,922	434,088
	Goat	103,974,602	98,574,297	100,712,755	134,594,996	146,917,088
	Kid	5,827,195	6,077,228	5,559,292	5,418,936	5,267,680
	Lamb	10,552,675	10,082,214	10,069,358	10,698,967	8,980,988
	Sheep	45,390,767	57,525,048	57,281,020	46,996,872	50,346,917
	Sheep and goat, mixed	10,720,438	9,984,766	9,830,475	10,407,936	8,601,681
	Unclassified	1,110,468	1,249,139	1,348,347	1,277,800	1,474,231
	Hides and skins, unclassified	181,501,980	203,475,102	203,737,313	199,383,421	232,486,905
Total		1,232,665,469	1,268,461,682	1,287,754,237	1,365,305,461	1,452,511,962

[a] Not including free ports.
[b] Preliminary.
[c] Average, 1901-1904.
[d] Number of pounds computed from stated number of hides or skins.

BUTTER.

International trade in butter, 1901–1905.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Argentina	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Australia	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Austria-Hungary	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Belgium	Jan. 1	5,929,984	[illegible]	[illegible]	[illegible]	[illegible]
Canada	July 1	27,855,978	[illegible]	[illegible]	[illegible]	[illegible]
Denmark	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Finland	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
France	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Germany[b]	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Italy	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Netherlands	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New Zealand	Jan. 1	[illegible]	28,447,776	[illegible]	[illegible]	[illegible]
Norway	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Russia	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sweden	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
United States	July 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other countries		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total		522,496,449	[illegible]	[illegible]	[illegible]	[illegible]

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Australia	Jan. 1	[illegible]	[illegible]	1,887,148	[illegible]	[illegible]
Belgium	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brazil	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cape of Good Hope	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Denmark	Jan. 1	[illegible]	[illegible]	12,786,808	15,607,270	[illegible]
Dutch East Indies	Jan. 1	[illegible]	2,788,108	[illegible]	[illegible]	c2,464,000
Egypt	Jan. 1	[illegible]	[illegible]	[illegible]	3,128,943	[illegible]
France	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Germany[b]	Jan. 1	[illegible]	[illegible]	[illegible]	73,706,858	[illegible]
Natal	Jan. 1	1,611,004	[illegible]	2,221,101	[illegible]	[illegible]
Netherlands	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Russia	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sweden	Jan. 1	[illegible]	2,148,809	[illegible]	1,307,925	[illegible]
Switzerland	Jan. 1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Transvaal	Jan. 1	e4,381,174	[illegible]	[illegible]	[illegible]	e4,381,174
United Kingdom	Jan. 1	409,125,508	[illegible]	[illegible]	[illegible]	[illegible]
Other		15,104,000	16,954,000	14,567,000	[illegible]	d15,986,000
Total		555,616,377	568,507,686	590,027,254	630,116,442	625,256,219

a See "General note," p. 546.
b Not including free ports.
c Preliminary figures.
d Average, 1901–1904.
e Average, 1902–1904.

CHEESE.

International trade in cheese, 1901–1905.[a]

EXPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Bulgaria	Jan. 1	6,449,020	5,651,335	7,064,385	6,624,517	7,227,816
Canada	July 1	200,946,401	229,099,925	233,980,716	215,733,259	215,834,543
France	Jan. 1	17,795,274	20,545,803	23,119,970	20,711,480	22,125,152
Germany [b]	Jan. 1	3,211,693	3,119,981	2,813,539	2,597,927	2,650,397
Italy	Jan. 1	24,104,455	28,841,967	33,158,617	30,299,443	[c] 37,694,647
Netherlands	Jan. 1	104,269,090	104,785,152	109,025,968	103,039,081	98,438,575
New Zealand	Jan. 1	11,680,928	8,371,552	8,375,360	9,466,912	9,918,944
Russia	Jan. 1	1,610,414	1,655,230	1,406,557	1,396,951	[c] 1,119,497
Switzerland	Jan. 1	60,075,729	54,491,422	53,642,863	56,088,989	61,383,731
United States	July 1	27,203,184	18,987,178	23,335,172	10,134,424	16,562,451
Other countries		7,924,000	9,469,000	8,833,000	7,050,000	[c] 5,092,000
Total		465,270,188	485,018,545	504,756,147	463,772,983	478,047,753

IMPORTS.

Country.	Year beginning—	1901.	1902.	1903.	1904.	1905.
Argentina	Jan. 1	3,265,535	3,614,879	2,489,821	4,069,223	4,234,616
Australia	Jan. 1	2,777,464	2,318,110	1,141,300	375,642	384,718
Austria-Hungary	Jan. 1	7,257,316	7,263,348	7,527,020	8,213,540	9,358,179
Belgium	Jan. 1	23,695,315	25,776,099	27,994,030	26,304,868	28,488,857
Brazil	Jan. 1	2,583,396	3,052,639	2,903,536	3,043,516	[c] 3,119,540
Cape of Good Hope	Jan. 1	3,268,640	3,689,735	4,251,460	3,994,730	3,249,035
Cuba	Jan. 1	3,256,525	3,119,835	2,900,902	3,333,992	[d] 3,152,814
Denmark	Jan. 1	2,140,688	2,085,131	2,052,503	2,033,764	7,472,566
Egypt	Jan. 1	6,702,653	6,947,708	6,947,710	8,495,738	9,512,371
France	Jan. 1	42,034,436	42,362,780	48,434,148	40,683,327	43,254,168
Germany [b]	Jan. 1	36,750,387	35,067,820	35,859,059	39,750,657	44,698,270
Italy	Jan. 1	10,797,577	8,859,053	9,474,363	9,568,500	[c] 9,921,901
Russia	Jan. 1	2,852,694	2,829,871	3,191,252	3,302,985	[c] 2,744,573
Spain	Jan. 1	4,129,100	4,280,926	4,033,420	4,338,306	[c] 4,033,420
Switzerland	Jan. 1	4,248,748	5,710,853	5,879,065	6,567,789	5,530,515
United Kingdom	Jan. 1	283,558,016	279,367,088	296,012,528	280,125,104	267,722,560
United States	July 1	17,057,714	20,671,384	22,707,103	23,095,705	27,286,866
Other countries		11,092,000	14,598,000	14,549,000	18,785,000	[c] 12,413,000
Total		467,488,204	471,625,259	498,348,220	486,082,386	486,577,969

[a] See "General note," p 546.
[b] Not including free ports.
[c] Preliminary figures.
[d] Average, 1901–1904.

FARM ANIMALS AND THEIR PRODUCTS IN CONTINENTAL UNITED STATES.

HORSES AND MULES.

Number and farm value of horses and mules, 1867–1907.

January 1—	Horses.			Mules.		
	Number.	Price per head.	Farm value.	Number.	Price per head.	Farm value.
1867	5,401,263	$59.05	$318,924,085	822,386	$66.94	$55,048,257
1868	5,756,940	54.27	312,416,048	855,685	56.04	47,958,624
1869	6,332,793	62.57	396,222,359	921,662	79.23	73,026,906
1870	8,248,800	67.49	556,250,529	1,179,500	90.42	106,654,015
1871	8,702,000	71.14	619,038,564	1,242,300	91.98	114,272,194
1872	8,990,900	67.41	606,111,449	1,276,300	87.14	111,221,919
1873	9,222,470	66.39	612,273,159	1,310,000	85.15	111,546,171
1874	9,333,800	65.15	608,072,797	1,339,350	81.35	108,952,659
1875	9,504,200	61.10	580,707,854	1,393,750	71.89	100,197,044
1876	9,735,300	57.29	557,746,731	1,414,500	66.46	94,000,976
1877	10,155,400	55.83	567,016,871	1,443,500	64.07	92,481,931
1878	10,329,700	56.63	584,998,503	1,637,500	62.03	101,579,278
1879	10,938,700	52.36	572,712,085	1,713,100	56.00	95,941,589
1880	11,201,800	54.75	613,296,611	1,729,500	61.26	105,948,319
1881	11,429,626	58.44	667,954,325	1,720,731	69.79	120,096,164
1882	10,521,554	58.53	615,824,914	1,835,169	71.35	130,945,378
1883	10,838,111	70.59	765,041,308	1,871,079	79.49	148,732,390
1884	11,169,683	74.64	833,734,400	1,914,126	84.22	161,214,976
1885	11,564,572	73.70	852,282,947	1,972,569	82.38	162,497,097
1886	12,077,657	71.27	860,823,208	2,052,593	79.60	163,381,096
1887	12,496,744	72.15	901,685,755	2,117,141	78.91	167,057,538
1888	13,172,936	71.82	946,096,154	2,191,727	79.78	174,853,563
1889	13,663,294	71.89	982,194,827	2,257,574	79.49	179,444,481
1890	14,213,837	68.84	978,516,562	2,331,027	78.25	182,394,099
1891	14,056,750	67.00	941,823,222	2,296,532	77.88	178,847,370
1892	15,498,140	65.01	1,007,593,636	2,314,699	75.55	174,882,070
1893	16,206,802	61.22	992,225,185	2,331,128	70.68	164,763,751
1894	16,081,139	47.83	769,224,799	2,352,231	62.17	146,232,811
1895	15,893,318	36.29	576,730,580	2,333,108	47.55	110,927,834
1896	15,124,057	33.07	500,140,186	2,278,946	45.29	103,204,457
1897	14,364,667	31.51	452,649,396	2,215,654	41.66	92,302,090
1898	13,960,911	34.26	478,362,407	2,190,282	43.88	96,109,516
1899	13,665,307	37.40	511,074,813	2,134,213	44.96	95,9[illegible],261
1900	13,537,524	44.61	603,969,442	2,086,027	53.55	111,717,092
1901	16,744,723	52.86	885,200,168	2,864,458	63.97	183,232,209
1902	16,531,224	58.61	968,935,178	2,757,017	67.61	186,411,704
1903	16,557,373	62.25	1,030,705,959	2,728,088	72.49	197,753,327
1904	16,736,059	67.93	1,136,940,298	2,757,916	78.88	217,532,832
1905	17,057,702	70.37	1,200,310,020	2,888,710	87.18	251,840,378
1906	18,718,578	80.72	1,510,889,906	3,404,361	98.31	334,680,520
1907	19,746,583	93.51	1,846,578,412	3,816,692	112.16	428,063,613

Imports and exports of horses and mules, with average prices, 1892–1906.

Year ended June 30—	Imports of horses.			Exports of horses.			Exports of mules.		
	Number.	Value.	Average price.	Number.	Value.	Average price.	Number.	Value.	Average price.
1892	14,074	$2,455,868	$174.50	3,226	$611,188	$189.46	1,965	$238,591	$121.42
1893	15,451	2,388,267	154.57	2,967	718,607	242.20	1,634	210,278	128.69
1894	6,166	1,319,572	214.01	5,246	1,108,995	211.40	2,063	240,961	116.80
1895	13,098	1,055,191	80.56	13,984	2,209,298	157.99	2,515	186,452	74.14
1896	9,991	662,591	66.32	25,126	3,530,703	140.52	5,918	406,161	68.63
1897	6,998	464,808	66.42	39,532	4,769,265	120.64	7,473	545,331	72.97
1898	3,085	414,899	134.49	51,150	6,176,569	120.75	8,098	664,789	82.09
1899	3,042	551,050	181.15	45,778	5,444,342	118.93	6,755	516,908	76.52
1900	3,102	596,592	192.32	64,722	7,612,616	117.62	43,369	3,919,478	90.38
1901	3,785	985,738	260.43	82,250	8,873,845	107.89	34,405	3,210,267	93.31
1902	4,832	1,577,234	326.41	103,020	10,048,046	97.53	27,586	2,692,298	97.60
1903	4,999	1,536,296	307.32	34,007	3,152,159	92.69	4,294	521,725	121.47
1904	4,726	1,460,287	308.99	42,001	3,189,100	75.93	3,658	412,971	112.90
1905	5,180	1,591,083	307.16	34,822	3,175,259	91.19	5,826	645,464	110.79
1906	6,021	1,716,675	285.11	40,087	4,365,981	108.91	7,167	989,639	138.08

Number, average price, and farm value of horses and mules in the United States January 1, 1907, by States.

State or Territory.	Horses.			Mules.		
	Number.	Average price per head Jan. 1.	Farm value.	Number.	Average price per head Jan. 1.	Farm value.
		Dollars.	*Dollars.*		*Dollars.*	*Dollars.*
Maine	115,500	106.00	12,254,550			
New Hampshire	60,600	93.00	5,657,010			
Vermont	92,721	101.00	9,380,552			
Massachusetts	80,800	113.00	9,105,352			
Rhode Island	13,667	119.00	1,624,285			
Connecticut	60,345	118.00	7,105,600			
New York	695,877	111.00	77,541,590	4,208	116.00	487,140
New Jersey	101,836	115.00	11,763,722	5,223	127.00	661,862
Pennsylvania	607,010	109.00	66,127,689	40,864	123.00	5,024,210
Delaware	36,503	103.00	3,768,955	5,824	120.00	699,909
Maryland	158,180	90.00	14,248,863	20,120	116.00	2,331,945
Virginia	307,920	99.00	30,481,026	50,733	137.00	6,972,232
West Virginia	186,850	95.00	17,704,056	10,986	101.00	1,111,569
North Carolina	185,846	114.00	21,182,748	174,714	136.00	23,740,137
South Carolina	83,026	126.00	10,437,182	134,690	153.00	20,598,121
Georgia	139,297	121.00	16,827,065	229,691	153.00	35,039,340
Florida	51,278	100.00	5,138,044	18,005	152.00	2,732,275
Ohio	940,440	113.00	105,893,580	19,728	114.00	2,250,150
Indiana	798,102	110.00	87,735,367	84,800	118.00	10,017,424
Illinois	1,575,000	109.00	171,990,000	141,909	117.00	16,668,630
Michigan	696,518	111.00	77,369,224	3,676	115.00	422,579
Wisconsin	637,500	107.00	68,340,000	4,985	106.00	527,358
Minnesota	723,141	97.00	70,260,365	8,657	94.00	816,090
Iowa	1,390,950	100.00	139,178,490	43,655	108.00	4,702,541
Missouri	948,420	93.00	87,937,525	315,250	104.00	32,893,203
North Dakota	580,880	96.00	55,689,001	8,457	103.00	869,324
South Dakota	548,760	84.00	45,909,244	7,970	86.00	685,574
Nebraska	994,850	87.00	86,362,944	69,300	102.00	7,063,749
Kansas	1,085,750	89.00	96,848,928	140,390	103.00	14,468,598
Kentucky	387,327	97.00	37,679,162	198,850	109.00	21,628,928
Tennessee	315,435	99.00	31,338,495	275,730	112.00	30,776,994
Alabama	158,245	87.00	13,767,307	231,750	121.00	28,139,085
Mississippi	257,295	79.00	20,418,951	274,437	114.00	31,409,335
Louisiana	224,076	69.00	15,550,875	165,791	115.00	19,055,981
Texas	1,277,641	62.00	79,456,496	631,050	93.00	58,763,376
Indian Territory	296,400	63.00	18,720,624	70,200	93.00	6,549,660
Oklahoma	432,361	78.00	33,598,782	91,742	101.00	9,242,067
Arkansas	278,761	73.00	20,304,966	206,944	93.00	19,270,625
Montana	291,970	63.00	18,379,534	3,917	80.00	314,939
Wyoming	119,054	55.00	6,528,928	1,526	82.00	124,717
Colorado	261,655	66.00	17,216,910	10,231	92.00	942,176
New Mexico	119,258	42.00	5,058,937	5,719	69.00	393,537
Arizona	99,249	41.00	4,024,554	4,001	77.00	309,849
Utah	113,827	55.00	6,310,563	3,560	62.00	219,657
Nevada	96,541	89.00	8,622,084	3,057	88.00	268,758
Idaho	149,551	71.00	10,594,186	2,397	89.00	212,155
Washington	296,400	88.00	26,195,832	4,128	101.00	418,560
Oregon	282,240	81.00	22,827,548	7,077	90.00	639,379
California	391,680	92.00	36,120,721	80,750	106.00	8,599,875
United States	19,746,583	93.51	1,846,578,412	3,816,692	112.16	428,063,613

Range of prices for horses in Omaha, monthly, 1902–1906.

Date.	Drafts.		General purposes.		Southern.		Western.		Drivers.		Carriage teams.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.												
January	$90	$175	$75	$85	$35	$80	$10	$50	$95	$225	$300	$550
February	95	185	60	100	35	80	10	50	95	225	200	350
March	100	200	60	100	35	80	10	50	95	225	200	450
April	100	225	60	110	30	65	10	50	100	250	200	500
May	100	250	65	105	25	60	12	60	90	325	300	500
June	90	200	60	90	20	45	12	60	90	325	300	450
July	90	175	40	80	15	45	10	65	75	200	200	400
August	90	175	40	80	15	45	10	80	75	220	210	420
September	90	175	40	80	15	45	10	100	85	175	215	360
October	100	175	40	80	20	45	10	100	90	215	175	435
November	90	160	40	80	20	65	10	80	90	325	230	370
December	100	185	45	85	20	70	12	60	90	300	200	375
1903.												
January	90	175	50	80	35	70	10	50	95	225	200	350
February	95	185	60	100	35	75	10	50	95	225	200	350
March	100	200	60	110	35	70	10	50	100	230	200	400
April	100	250	60	110	30	65	10	50	100	250	200	500
May	110	250	65	105	20	55	12	60	100	250	250	550
June	90	200	65	100	15	40	12	60	100	375	300	450
July	90	175	50	80	15	45	10	65	75	275	200	400
August	90	175	45	80	15	45	10	90	75	220	210	420
September	90	175	40	80	15	45	10	100	95	200	215	360
October	100	180	40	80	20	45	10	100	90	215	200	435
November	90	160	45	85	20	60	10	80	100	325	225	370
December	100	185	45	85	20	60	12	60	100	300	200	375
1904.												
January	120	175	65	90	45	90	10	50	75	150	300	400
February	120	175	70	90	40	80	10	50	75	150	300	400
March	120	175	75	95	35	70	10	50	75	150	300	400
April	125	200	75	100	30	65	10	50	90	175	300	400
May	140	275	90	125	30	65	15	35	125	300	300	750
June	135	250	75	110	30	60	15	40	125	300	300	700
July	125	300	65	100	30	60	15	65	120	175	300	400
August	120	175	50	90	30	60	15	90	100	175	300	400
September	120	175	60	100	30	60	15	110	100	175	300	400
October	125	200	65	100	40	75	15	100	125	200	300	450
November	130	235	70	100	40	90	10	35	125	200	300	450
December	130	225	70	100	45	75	12	60	125	200	300	400
1905.												
January	150	200	75	110	40	90	10	50	75	150	300	400
February	150	200	85	125	40	90	10	50	75	150	300	400
March	150	200	90	135	35	90	10	50	75	150	300	400
April	150	225	75	120	35	80	10	50	90	175	300	400
May	150	265	60	90	30	80	15	40	90	300	300	750
June	135	225	60	90	30	75	15	50	90	300	300	750
July	125	200	60	100	30	70	15	75	100	150	300	400
August	130	200	60	100	30	70	15	117	100	150	300	400
September	130	200	65	100	35	75	15	110	100	150	300	400
October	140	200	70	110	45	85	15	95	100	175	300	450
November	150	250	80	125	30	100	15	70	125	200	300	450
December	150	250	80	120	50	95	10	65	125	200	300	400
1906.												
January	140	225	85	135	40	90	10	50	100	175	300	400
February	140	225	85	135	35	90	10	50	100	175	300	450
March	140	250	85	135	35	80	10	50	100	175	300	450
April	140	275	80	130	30	75	10	50	100	175	300	500
May	140	335	75	110	30	85	15	50	100	350	300	750
June	135	275	75	150	30	75	15	115	100	300	300	750
July	125	225	75	150	40	90	15	120	100	150	300	400
August	130	225	75	150	40	90	15	120	100	200	300	400
September	130	225	75	150	40	90	15	122	100	225	300	500
October	140	250	75	150	40	90	15	80	100	200	300	450
November	150	250	85	150	35	90	15	75	125	200	300	450
December	150	250	85	150	35	90	10	65	125	200	300	400

CATTLE.

Number and value of milch cows and other cattle, 1867–1907.

January 1—	Milch cows.			Other cattle.		
	Number.	Price per head.	Farm value.	Number.	Price per head.	Farm value.
1867	8,348,773	$28.74	$230,946,612	11,730,952	$15.79	$185,253,850
1868	8,691,568	26.56	230,816,717	11,942,484	15.06	179,887,797
1869	9,247,714	29.15	269,610,021	12,185,385	18.73	228,183,001
1870	10,095,600	32.70	330,175,234	15,388,500	18.87	290,400,588
1871	10,023,000	33.89	339,700,528	16,212,200	20.78	336,859,617
1872	10,303,500	29.45	303,438,398	16,389,800	18.12	296,931,664
1873	10,575,900	26.72	282,559,051	16,413,800	18.06	296,448,036
1874	10,705,300	25.63	274,325,680	16,218,100	17.[illegible]5	284,705,983
1875	10,906,800	25.74	280,700,645	16,313,400	16.91	275,871,664
1876	11,085,400	25.61	283,878,809	16,785,300	17.00	285,387,123
1877	11,260,800	25.47	286,778,030	17,956,100	15.99	287,155,528
1878	11,300,100	25.74	290,897,809	19,223,300	16.72	321,345,691
1879	11,826,400	21.71	256,720,779	21,408,100	15.38	329,253,631
1880	12,027,000	23.27	279,899,420	21,231,000	16.10	341,761,154
1881	12,368,653	23.95	296,277,060	20,938,710	17.33	362,861,509
1882	12,611,632	25.89	326,489,310	23,280,238	19.89	463,069,501
1883	13,125,685	30.21	396,575,405	28,046,077	21.81	611,549,109
1884	13,501,206	31.37	423,486,649	29,046,101	23.52	683,229,054
1885	13,904,722	29.70	412,903,093	29,866,5[illegible]3	23.25	694,382,913
1886	14,235,388	27.40	389,985,523	31,275,242	21.17	661,956,274
1887	14,522,083	26.08	378,789,589	33,511,750	19.79	663,137,926
1888	14,856,414	24.65	366,252,173	34,378,363	17.79	611,750,520
1889	15,298,625	23.94	366,226,376	35,032,417	17.05	597,236,812
1890	15,952,883	22.14	353,152,133	36,849,024	15.21	560,625,137
1891	16,019,591	21.62	346,397,900	36,875,648	14.76	544,127,908
1892	16,416,351	21.40	351,378,132	37,651,239	15.16	570,749,155
1893	16,424,087	21.75	357,299,785	35,954,196	15.24	547,882,204
1894	16,487,400	21.77	358,998,661	36,608,168	14.66	536,789,747
1895	16,504,629	21.97	362,601,729	34,364,216	14.06	482,999,129
1896	16,137,586	22.55	363,955,545	32,085,409	15.86	508,928,416
1897	15,941,727	23.16	369,239,993	30,508,408	16.65	507,929,421
1898	15,840,886	27.45	434,813,826	29,264,197	20.92	612,296,634
1899	15,990,115	29.66	474,233,925	27,994,225	22.79	637,931,135
1900	16,292,360	31.60	514,812,106	27,610,054	24.97	689,486,260
1901	16,833,657	30.00	505,093,077	45,500,213	19.93	906,644,003
1902	16,696,802	29.23	488,130,324	44,727,797	18.76	839,126,073
1903	17,105,227	30.21	516,711,914	44,659,206	18.45	824,054,902
1904	17,419,817	29.21	508,841,489	43,629,498	16.32	712,178,134
1905	17,572,464	27.44	482,272,203	43,669,443	15.15	661,571,308
1906	19,793,866	29.44	582,788,592	47,067,656	15.85	746,171,709
1907	20,968,265	31.00	645,496,980	51,565,731	17.10	881,557,398

Imports and exports of live cattle, with average prices, 1892–1906.

Year ended June 30—	Imports.			Exports.		
	Number.	Value.	Average price.	Number.	Value.	Average price.
1892	2,168	$47,466	$21.89	394,607	$35,099,095	$88.95
1893	3,293	45,682	13.87	287,094	26,032,428	90.68
1894	1,592	18,704	11.75	359,278	33,461,922	93.14
1895	149,781	765,853	5.11	331,722	30,603,796	92.26
1896	217,826	1,509,856	6.93	372,461	34,560,672	92.79
1897	328,977	2,589,857	7.87	392,190	36,357,451	92.70
1898	291,589	2,913,223	9.99	439,255	37,827,500	86.12
1899	199,752	2,320,362	11.62	389,490	30,516,833	78.35
1900	181,006	2,257,694	12.47	397,286	30,635,153	77.11
1901	146,022	1,931,433	13.23	459,218	37,566,980	81.81
1902	96,027	1,608,722	16.75	392,884	29,902,212	76.11
1903	66,175	1,161,548	17.55	402,178	29,848,936	74.22
1904	16,056	310,737	19.35	593,409	42,256,291	71.21
1905	27,855	458,572	16.46	567,806	40,598,048	71.50
1906	29,019	548,430	18.90	584,239	42,081,170	72 03

Number, average price, and farm value of cattle in the United States on January 1, 1907.

State or Territory.	Milch cows.			Other cattle.		
	Number.	Average price per head, Jan. 1.	Farm value.	Number.	Average price per head, Jan. 1.	Farm value.
Maine	185,286	$31.00	$5,743,866	156,985	$16.00	$2,511,677
New Hampshire	132,498	33.00	4,372,434	106,350	17.00	1,772,860
Vermont	293,931	28.00	8,230,068	225,870	15.00	3,376,751
Massachusetts	200,273	42.00	8,411,466	93,371	18.00	1,676,937
Rhode Island	25,721	42.00	1,080,282	10,443	20.00	210,433
Connecticut	137,485	37.00	5,086,945	84,028	20.00	1,695,680
New York	1,826,211	36.00	65,743,596	944,734	18.00	17,307,526
New Jersey	190,193	44.00	8,368,492	82,003	20.00	1,658,107
Pennsylvania	1,141,494	36.00	41,093,784	984,750	18.00	17,479,308
Delaware	36,905	35.00	1,291,675	22,455	19.00	436,075
Maryland	153,364	31.00	4,754,284	140,732	18.00	2,576,808
Virginia	290,700	28.00	8,139,600	566,500	18.00	10,253,650
West Virginia	244,800	31.00	7,588,800	559,980	21.00	11,703,574
North Carolina	282,600	24.00	6,782,400	445,954	12.00	5,199,826
South Carolina	136,911	28.00	3,833,508	218,502	12.00	2,619,840
Georgia	305,469	30.00	9,164,070	679,911	11.00	7,451,822
Florida	89,638	30.00	2,689,140	656,600	11.00	7,045,318
Ohio	919,100	34.00	31,249,400	1,105,380	22.00	23,787,780
Indiana	652,610	33.00	21,536,103	1,141,778	21.00	24,080,090
Illinois	1,161,500	35.00	40,652,500	2,231,000	22.00	49,238,170
Michigan	832,000	34.00	28,288,000	1,045,000	17.00	17,326,100
Wisconsin	1,365,000	31.00	42,315,000	1,148,124	15.00	16,785,580
Minnesota	1,019,700	29.00	29,571,300	1,305,000	13.00	17,460,900
Iowa	1,555,300	32.00	49,769,600	3,960,000	23.00	90,288,000
Missouri	975,100	27.00	26,327,700	2,397,000	19.00	45,950,490
North Dakota	220,178	27.00	5,944,806	682,880	18.00	12,360,128
South Dakota	605,768	28.00	16,961,504	1,485,000	19.00	28,823,850
Nebraska	870,135	29.00	25,233,915	3,366,000	19.00	65,367,720
Kansas	729,274	28.00	20,419,672	3,764,700	20.00	73,844,591
Kentucky	402,000	28.00	11,256,000	736,250	18.00	12,972,716
Tennessee	328,250	23.00	7,549,750	601,000	12.00	7,212,000
Alabama	282,800	21.00	5,938,800	561,000	9.00	4,908,750
Mississippi	329,669	21.00	6,923,049	600,950	9.00	5,468,644
Louisiana	188,141	24.00	4,515,384	479,750	10.00	4,965,414
Texas	993,122	24.75	24,579,770	8,236,549	12.00	100,856,544
Indian Territory	111,547	24.00	2,677,128	503,000	13.00	6,782,955
Oklahoma	198,102	24.00	4,754,448	1,387,151	16.00	22,867,179
Arkansas	400,000	17.50	7,000,000	739,000	7.00	5,512,940
Montana	65,948	35.00	2,308,180	916,350	20.00	18,134,570
Wyoming	21,813	40.00	872,520	855,000	22.00	19,023,750
Colorado	136,712	36.00	4,921,632	1,425,000	20.00	28,172,250
New Mexico	21,820	37.00	807,340	948,240	17.00	15,788,194
Arizona	21,791	40.00	871,640	597,078	17.00	10,405,872
Utah	75,919	30.00	2,277,570	306,000	18.00	5,661,000
Nevada	16,988	36.00	611,568	386,120	18.00	6,925,451
Idaho	66,345	32.00	2,123,040	351,086	17.00	5,856,118
Washington	173,724	34.00	5,906,616	409,050	17.00	6,850,568
Oregon	148,814	32.00	4,762,048	750,000	15.00	11,428,125
California	405,616	35.00	14,196,560	1,167,107	18.00	21,474,767
United States	20,968,265	31.00	645,496,980	51,565,731	17.10	881,557,398

Wholesale prices of cattle per 100 pounds, 1902–1906.

Date.	Chicago. Inferior to prime.		Cincinnati. Fair to medium.		St. Louis. Good to choice native steers.		Omaha. Native beeves.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.								
January	$2.20	$7.75	$3.75	$4.65	$6.10	$7.00	$3.40	$6.55
February	2.25	7.35	3.65	4.75	6.35	6.50	3.50	6.25
March	2.35	7.35	3.75	5.25	6.40	6.75	4.00	6.70
April	2.35	7.50	4.25	5.40	6.95	7.10	4.50	7.00
May	2.50	7.70	4.10	5.35	6.90	7.50	4.35	7.40
June	2.35	8.50	3.25	5.25	7.50	8.00	4.25	7.85
July	2.25	8.85	3.15	5.25	7.50	8.35	5.00	8.15
August	2.40	9.00	3.25	5.25	7.40	8.75	5.00	8.15
September	2.25	8.85	3.00	4.40	6.60	8.00	4.15	7.85
October	1.90	8.75	2.90	4.25	6.35	7.10	4.50	7.25
November	2.00	7.40	3.00	4.15	5.15	7.25	3.20	6.00
December	2.00	14.50	3.00	4.25	5.25	6.00	3.00	6.25
1903.								
January	2.00	6.85	3.15	4.35	5.10	5.75	3.35	5.10
February	2.35	6.15	3.10	4.25	5.10	5.25	3.15	5.15
March	2.50	5.75	3.35	4.40	5.10	5.40	3.45	5.35
April	2.50	5.80	3.75	4.40	5.10	5.60	3.20	5.25
May	2.50	5.65	3.25	4.40	5.00	5.50	3.85	5.10
June	2.25	5.65	3.00	4.40	5.10	5.25	3.75	5.30
July	2.25	5.65	2.85	4.10	5.15	5.35	3.65	5.35
August	2.15	6.10	2.50	4.00	5.25	5.55	3.85	5.75
September	2.00	6.15	2.25	3.75	5.60	5.70	3.60	5.75
October	1.65	6.00	2.50	3.65	5.40	5.55	3.90	5.50
November	1.50	5.85	2.35	3.40	5.15	5.40	3.00	5.30
December	1.50	8.35	2.35	3.75	5.10	6.00	2.65	5.30
1904.								
January	2.10	5.90	3.00	4.00	5.15	5.35	3.20	5.10
February	2.25	6.00	3.00	3.75	4.90	5.35	3.00	5.50
March	2.15	6.00	3.00	4.00	5.00	5.35	2.75	5.20
April	2.25	5.80	3.15	4.00	5.25	5.40	3.00	5.10
May	2.35	5.85	3.10	4.25	5.05	5.35	3.00	5.55
June	2.35	6.70	3.00	4.25	5.75	6.40	3.50	6.25
July	2.20	6.65	3.00	4.25	5.90	6.25	3.40	6.00
August	2.20	6.40	2.65	4.00	5.60	6.00	3.25	5.85
September	2.15	6.40	2.50	3.75	5.75	6.00	4.00	6.00
October	1.70	7.00	2.50	3.75	6.05	6.60	4.25	6.35
November	1.70	7.15	2.50	3.50	5.15	6.60	3.10	6.15
December	1.80	7.65	2.25	3.60	5.75	6.00	3.10	6.15
1905.								
January	1.85	6.30	2.65	3.85	5.15	5.50	3.05	5.35
February	1.90	6.45	2.65	4.00	5.15	6.00	3.15	5.25
March	2.20	6.25	2.50	4.40	5.50	5.65	3.20	5.65
April	2.40	7.00	3.50	4.75	5.90	6.75	3.25	6.50
May	2.35	6.85	3.15	4.65	5.85	6.50	3.75	6.30
June	2.30	6.35	3.00	4.25	5.25	6.50	3.70	5.95
July	2.00	6.25	3.00	4.40	5.25	5.85	3.50	5.40
August	2.10	6.30	2.85	4.10	5.50	5.70	3.25	6.15
September	2.00	6.50	2.75	4.00	5.50	6.35	3.40	5.90
October	2.10	6.40	2.50	3.85	6.00	6.15	3.10	5.75
November	2.15	6.60	2.35	3.75	5.40	6.15	3.50	6.50
December	2.15	7.00	2.65	4.00	5.50	7.10	3.05	5.60
1906.								
January	2.00	6.50	2.85	4.00	5.45	6.00	3.10	5.50
February	2.10	6.40	3.25	4.35	5.65	6.00	3.00	5.60
March	2.25	6.35	3.25	4.50	5.75	6.00	3.10	5.60
April	2.35	6.35	3.00	4.40	5.50	5.75	3.35	5.50
May	2.50	6.20	3.00	4.35	5.45	5.80	3.50	5.65
June	1.75	6.10	2.75	4.00	5.50	6.00	3.35	5.70
July	2.00	6.50	2.60	4.40	5.85	6.10	3.10	6.25
August	2.00	6.85	2.50	4.25	5.85	6.30	3.05	6.25
September	2.05	6.95	2.50	4.40	6.25	6.40	2.90	6.40
October	2.00	6.95	2.40	4.35	6.15	6.75	3.75	6.35
November	1.75	7.40	2.35	4.50	5.85	7.00	3.25	6.40
December	1.75	7.90	2.75	4.50	6.00	7.00	3.00	6.85

BUTTER.

Wholesale prices of butter per pound in leading cities of the United States, 1902–1906.

Date.	New York.		Cincinnati.		Chicago.		Elgin.	
	Creamery extra.		Creamery.		Creamery firsts.		Creamery extra.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	23	26	22	23	20	24	24	24½
February	26	30	22	26	20	29	25½	29
March	27	30	23	24	22	28	26	28
April	22	33	23	27	18	31	22	30
May	22¼	25	19	20	19	23	22	22
June	21½	22½	19	20	18½	22	21	22
July	20½	21¾	18	21	18½	21½	20	21
August	19	20½	17	19	16	20	19	20
September	19½	23	17	21½	17	22½	19	22½
October	22½	25	20½	22½	19	24½	22½	24½
November	25	28½	21½	25	21½	27	24½	27
December	28	30	25	27	23	28½	28	29
1903.								
January	28½	28½	22	27	20	28	25	29
February	26	28	22	25	20	27½	25	27
March	27	29½	24½	26	24	28½	27½	28½
April	22½	29½	19½	26	21	28½	22½	28½
May	22	23	17½	20½	17	22	20	22½
June	20½	22½	18	21	18	22	20	22
July	19	20½	15½	20	17	20	18½	20
August	19	19¾	15½	18½	16	19	18½	19½
September	19¾	21¾	16½	20	17	21½	19½	21½
October	20	22¾	18	20	17	21½	20½	21½
November	22½	25½	19½	22½	18	24½	22	24
December	23	25½	21½	23½	19	25	24	25
1904.								
January	22	24½	19½	22½	17	23½	22	24
February	23	26½	21½	24	18	26	23	26
March	24	26½	22	24	19	26	24½	26
April	22	24½	20½	23	19	24½	23	24½
May	18	24½	17½	21½	15	23	17½	23
June	17¾	18¾	17½	19	15	18	17½	17½
July	17½	18	17	19	15	18	17	17½
August	17½	19¼	17	19	15	18½	17	19
September	19	21	19	20½	16½	19½	19	20
October	20	23¼	20	22	17	22	20	23
November	23	26½	23	25½	19	24½	23	25
December	26	28	26½	28	20	28	25	28
1905.								
January	28	30½	28	30½	22	30	28	29½
February	29½	35½	30	34	25	34	29	34
March	25	31½	24	30	22	32	25	33
April	27	32	26	32	22	31	27	31½
May	20¾	27	20½	25	18	24	21	25
June	19½	21½	19	21	18	20½	19½	20½
July	20½	21¼	19½	20½	18	20½	20	20
August	20½	22	20	21½	18½	21	20	21
September	20¼	21¾	20	21½	18	21	20½	21
October	20	22	20½	23	19	22	21	22½
November	17½	24½	22	24½	20	23	22½	24
December	24	26	23½	25	19	24½	24	25
1906.								
January	25	27½	25½	27	20	27	26	27
February	26	27½	26½	29½	22	27½	27	28½
March	27	27½	27	28	21	27½	27	28½
April	21	25½	21	27	17	26½	21	26
May	19¼	22	19	22	16½	20	19	21
June	19¼	21	19½	21	16½	21	19½	20
July	20½	21½	20	22½	18	20	20	21½
August	21	24½	21½	24	18	23	21½	23
September	24	25½	24	25½	20½	24	24	24½
October	25½	27	24½	27	22	25½	24½	26
November	27	30½	26	31	22	28½	26	30
December	30½	33	30	32½	25	31	30	31½

CHEESE.

Wholesale prices of cheese per pound in leading cities of the United States, 1902–1906.

Date.	New York.		Cincinnati.		Chicago.		St. Louis.	
	September, colored.		Factory.		Young Americas.		Full cream.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1902.								
January	11¼	11¾	10	11	10½	11¼	10¾	11½
February	11½	12½	10½	11½	10½	12½	12½	13
March	12¼	13¼	11	11½	11¾	12¼	13	14
April	13	13¼	11	12½	13	13	13¾	14½
May	10½	13	11½	12½	12¾	13½	12¾	14
June	9½	9¾	10½	12½	10¼	12¾	11	11½
July	9¾	10¼	10½	10½	10½	10¾	11½	11½
August	9½	10½	10½	10½	10½	11	11½	11¾
September	10⅜	12	10½	10½	10½	11¼	11¼	12
October	12	12½	11	12½	11¼	11¾	11¾	12½
November	12½	13	12	12½	11½	12	12¾	13½
December	13	13½	12	13	11½	13¼	13¾	14
1903.								
January	14	14	12½	12¾	13	13½	14	14¼
February	14½	14½	12½	12½	12½	13	14¼	14¼
March	14½	15	12½	12½	12½	13¼	14¼	14¼
April	15	15	12½	12½	12½	13¼	13½	14¼
May	11½	12¼	12½	12½	10½	13¾	12¾	14¾
June	•10½	10¾	11	11¼	10½	10½	11½	11¾
July	10	10½	10½	10¾	10	10¾	11¾	12
August	10¼	10½	10½	10½	9	11	11¾	12
September	10⅜	13¼	10½	10½	9½	11	11¾	12¼
October	11½	12¼	10½	10½	10	11	11¾	12¼
November	11½	12	10½	10½	10	10½	11½	11½
December	12	12	10½	10½	10	10	11½	11½
1904.								
January	12	12	10½	10½	10	10	11½	11½
February	12	12	10½	10½	9½	10½	11½	11¾
March	12	12	10½	10½	10	10¾	12	12
April	10¾	12	10½	10½	9	10	9	11½
May	7	8	9½	10	8	9	10¼	10¼
June	7¾	9	8	9½	7¼	8½	9¼	10¼
July	8	9	8	8½	7¼	8¾	9¼	9¾
August	8	9	8	9	7¾	8¾	9½	10
September	8¾	10	8½	9	8	8½	10	10¾
October	10	10½	8½	9	8¼	10½	11	11½
November	10¼	11¾	8½	10½	10	11½	11¾	13¼
December	11¾	12	10	10½	11	11½	13½	13½
1905.								
January	11½	11¾	12½	13	11¾	12	13½	13¾
February	11¾	13¼	12½	13	11¾	13½	13¾	14½
March	13¾	14½	12½	14¼	....	13½	14½	15
April	13¾	14¼	11	14¼	13½	14	14	15½
May	14¼	14¼	14	14¼	10	14	11½	15½
June	9	9¾	10	12¼	10	10½	11¼	11½
July	9½	11⅛	10	10½	10¼	11¼	11¾	12¼
August	10¼	12	11	11¼	11	11¾	12	12½
September	11¾	12	11	12½	11½	11¾	12½	12¾
October	11⅜	13¼	12	12½	11½	12¼	12½	13½
November	13¼	13¾	13½	14	13	13¾	14	14
December	12	14	13½	14	13	13½	13¼	13½
1906.								
January	14	14½	12½	13½	....	13	13¼	13¼
February	14	14¼	13½	....	....	13	13¼	13¼
March	14	14¼	13½	....	11½	13	13	13¼
April	14¼	14¼	13½	....	11	12	12¼	13
May	9½	14¼	11	13½	9½	11¾	11¼	12¼
June	9½	11	11	....	10½	11½	11⅝	12½
July	11	11½	11	....	11¼	11¾	12½	12¾
August	11½	12¾	12	13	12	12¾	12¾	14
September	12½	13	13	....	12¼	12½	13½	14
October	13¼	13½	13	13¾	12½	13¼	14	14½
November	13¼	14	13½	13¾	13	13¾	14¼	15¼
December	14	14½	13½	14	13½	14	15¼	15¼

SHEEP AND WOOL.

Number and farm value of sheep, 1867–1907.

January 1—	Sheep.			January 1—	Sheep.		
	Number.	Price per head.	Farm value.		Number.	Price per head.	Farm value.
1867	39,385,386	$2.50	$98,644,878	1888	43,544,755	$2.05	$89,279,926
1868	38,991,912	1.82	71,053,371	1889	42,599,079	2.13	90,640,369
1869	37,724,279	1.64	62,036,762	1890	44,336,072	2.27	100,659,761
1870	40,853,000	1.96	79,876,[illegible]	1891	43,431,136	2.50	108,397,447
1871	31,851,000	2.14	68,309,110	1892	44,938,365	2.58	116,121,290
1872	31,679,300	2.61	82,767,741	1893	47,273,553	2.66	125,909,264
1873	33,002,400	2.71	89,427,[illegible]	1894	45,048,017	1.98	89,186,110
1874	33,938,200	2.43	82,353,[illegible]	1895	42,294,064	1.58	66,685,767
1875	33,783,600	2.55	86,278,[illegible]	1896	38,298,783	1.70	65,167,735
1876	35,935,300	2.37	85,121,[illegible]	1897	36,818,643	1.82	67,020,942
1877	35,804,200	2.13	76,362,[illegible]	1898	37,656,960	2.46	92,721,133
1878	35,740,500	2.21	78,897,[illegible]	1899	39,114,453	2.75	107,697,530
1879	38,123,800	2.07	78,965,[illegible]	1900	41,883,065	2.93	122,665,913
1880	40,765,900	2.21	90,230,537	1901	59,756,718	2.98	178,072,476
1881	43,569,899	2.39	104,070,761	1902	62,039,091	2.65	164,446,091
1882	45,016,224	2.37	106,595,954	1903	63,964,876	2.63	168,315,750
1883	49,237,291	2.53	124,365,835	1904	51,630,144	2.59	133,530,099
1884	50,626,626	2.37	119,902,706	1905	45,170,423	2.82	127,331,850
1885	50,360,243	2.14	107,960,650	1906	50,631,619	3.54	179,056,144
1886	48,322,331	1.91	92,443,867	1907	53,240,282	3.84	204,210,129
1887	44,759,314	2.01	89,872,839				

Number, average price, and farm value of sheep in the United States on January 1, 1907.

State or Territory.	Number.	Average price per head Jan. 1.	Farm value.	State or Territory.	Number.	Average price per head Jan. 1.	Farm value.
Maine	297,325	$4.02	$1,195,151	South Dakota	861,080	$3.89	$3,350,019
New Hampshire	78,232	3.81	298,064	Nebraska	457,804	4.09	1,872,458
Vermont	223,967	4.10	918,[illegible]	Kansas	237,381	4.10	977,557
Massachusetts	44,577	4.45	198,[illegible]	Kentucky	1,060,000	4.22	4,473,500
Rhode Island	8,095	3.92	31,552	Tennessee	344,654	3.01	1,037,[illegible]
Connecticut	33,594	4.74	158,[illegible]	Alabama	189,729	2.03	384,091
New York	1,128,096	5.09	5,[illegible]	Mississippi	183,280	1.73	316,705
New Jersey	44,168	4.81	212,502	Louisiana	189,142	1.90	359,[illegible]
Pennsylvania	1,042,058	4.84	5,[illegible]	Texas	1,665,903	2.67	4,451,119
Delaware	11,104	4.05	45,[illegible]	Indian Territory	30,977	2.55	79,097
Maryland	164,877	4.51	744,572	Oklahoma	58,785	3.50	205,274
Virginia	512,201	3.88	1,98[illegible]	Arkansas	295,750	2.02	597,986
West Virginia	[illegible]	4.21	1,917,130	Montana	5,497,731	3.70	20,[illegible],283
North Carolina	223,965	2.44	546,[illegible]	Wyoming	4,998,796	3.85	19,244,045
South Carolina	69,124	2.31	159,[illegible]	Colorado	1,677,501	3.55	5,955,[illegible]
Georgia	276,072	1.99	550,775	New Mexico	4,558,765	2.95	13,448,563
Florida	101,256	2.20	222,[illegible]	Arizona	859,297	3.01	2,585,926
Ohio	3,140,725	4.81	15,109,427	Utah	2,855,250	3.90	11,121,953
Indiana	1,240,808	5.11	6,344,[illegible]	Nevada	1,509,977	3.81	5,757,542
Illinois	777,022	5.20	4,040,[illegible]	Idaho	3,648,133	3.61	13,184,453
Michigan	2,108,795	4.80	10,[illegible],117	Washington	824,129	3.55	2,928,542
Wisconsin	1,027,423	4.21	4,[illegible]	Oregon	2,688,900	3.53	9,490,576
Minnesota	436,532	4.00	1,744,626	California	2,422,428	3.30	8,006,107
Iowa	708,402	5.12	3,747,574				
Missouri	997,308	4.35	4,343,115	United States	53,240,282	3.84	204,210,129
North Dakota	674,499	3.67	2,476,429				

Imports and exports of sheep, with average prices, 1892–1906.

Year ended June 30—	Imports.			Exports.		
	Number.	Value.	Average price.	Number.	Value.	Average price.
1892	380,814	$1,440,530	$3.78	46,960	$161,105	$3.43
1893	459,484	1,682,977	3.66	37,260	126,394	3.39
1894	242,568	788,181	3.25	132,370	832,763	6.29
1895	291,461	682,618	2.34	405,748	2,630,686	6.48
1896	322,692	853,530	2.65	491,565	3,076,384	6.26
1897	405,633	1,019,668	2.51	244,120	1,531,645	6.27
1898	392,314	1,106,322	2.82	199,690	1,213,886	6.08
1899	345,911	1,200,081	3.47	143,286	853,555	5.96
1900	381,792	1,365,026	3.58	125,772	733,477	5.83
1901	331,488	1,236,277	3.73	297,925	1,933,000	6.49
1902	266,953	956,711	3.58	358,720	1,940,060	5.41
1903	301,623	1,036,934	3.44	176,961	1,067,860	6.03
1904	238,094	815,289	3.42	301,313	1,954,604	6.49
1905	186,942	704,721	3.77	268,365	1,687,321	6.29
1906	240,747	1,020,359	4.24	142,690	804,090	5.64

Prices of sheep per 100 pounds in leading cities of the United States, 1902–1906.

Date.	Chicago.		Cincinnati.		St. Louis.		Omaha.	
	Inferior to choice.		Good to extra.		Good to choice natives.		Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.								
January	$2.00	$4.75	$3.00	$4.25	$4.25	$5.00	$4.00	$5.15
February	2.00	5.50	3.50	5.50	4.75	5.60	4.20	5.85
March	3.00	5.75	4.25	5.50	5.50	5.75	4.40	5.90
April	2.50	6.50	3.75	5.50	5.50	6.25	4.75	6.25
May	2.25	6.50	4.35	5.75	6.00	6.35	5.40	6.00
June	1.50	6.25	3.50	4.60	3.70	5.60	4.50	6.00
July	1.75	5.00	3.10	4.00	4.00	4.60	3.80	4.50
August	1.50	4.25	2.25	4.00	3.85	4.35	....	....
September	1.50	4.50	2.00	3.40	3.65	4.00	2.00	3.40
October	1.50	4.25	2.65	3.40	3.90	4.00	3.00	4.10
November	1.50	4.25	2.50	3.35	3.75	4.00	3.40	4.25
December	1.25	4.75	2.75	4.00	3.80	4.50	3.50	4.75
1903.								
January	1.50	5.25	3.25	4.50	4.50	5.00	3.60	5.40
February	2.00	5.75	3.75	5.00	5.25	5.25	4.50	5.80
March	2.00	7.00	4.25	6.00	5.50	6.15	4.60	6.75
April	2.25	7.00	4.10	6.25	6.00	6.25	4.50	6.75
May	1.60	6.25	3.60	4.75	4.50	5.25	4.00	5.50
June	2.00	6.00	3.00	4.50	4.50	4.75	3.80	5.50
July	1.50	5.25	2.90	4.00	3.75	4.75	3.00	4.50
August	1.50	4.25	2.75	3.35	3.50	3.85	3.00	4.00
September	1.50	4.25	2.60	3.40	3.65	4.00	3.50	3.50
October	1.50	4.25	2.75	3.50	3.65	4.00	3.55	3.55
November	1.25	4.35	2.60	3.35	3.60	3.65	3.25	4.00
December	1.50	4.25	2.60	3.75	3.65	3.85	3.25	4.40
1904.								
January	2.00	4.75	3.25	4.00	3.75	4.75	2.25	5.10
February	2.00	4.75	3.40	4.60	4.75	4.75	2.60	5.25
March	2.00	5.50	3.65	4.50	4.75	4.90	2.50	5.25
April	2.50	6.00	4.00	4.50	5.40	5.60	3.25	5.65
May	2.00	6.00	3.75	4.55	5.50	5.65	4.00	5.90
June	1.75	5.50	3.00	4.40	4.60	5.50	4.00	5.25
July	1.50	5.50	2.75	4.00	4.00	4.25	3.75	5.00
August	2.00	4.25	2.75	4.00	3.75	4.00	3.40	4.35
September	1.75	4.50	2.75	3.50	3.75	4.00	....	....
October	1.50	4.75	2.75	3.50	4.10	4.50	....	....
November	1.75	5.00	2.75	4.00	4.25	4.75	3.75	4.50
December	2.50	5.65	3.50	4.50	4.75	4.90	4.00	5.50
1905.								
January	4.50	5.85	4.10	5.25	5.15	6.35	3.25	6.25
February	4.50	6.25	4.50	5.50	5.50	6.15	3.00	6.90
March	4.75	6.25	4.75	5.50	5.85	6.25	3.00	6.75
April	4.50	6.30	4.50	5.25	5.25	5.90	2.75	6.75
May	4.00	5.50	3.85	5.00	5.00	5.40	2.50	6.00
June	4.00	5.25	3.60	4.35	4.80	5.00	2.50	5.70
July	4.00	5.90	3.60	4.75	5.00	5.50	4.75	6.00
August	4.00	5.65	3.75	4.50	4.60	5.20	4.00	5.30
September	3.80	5.40	4.00	4.75	5.00	5.00	3.75	5.25
October	4.00	5.70	4.00	5.25	5.25	5.60	4.00	6.00
November	4.25	6.10	4.10	5.00	5.25	5.75	4.25	6.00
December	4.25	6.25	4.10	5.15	5.50	6.00	4.50	6.25

Prices of sheep per 100 pounds in leading cities of the United States, 1902–1906—Cont'd.

Date.	Chicago.		Cincinnati.		St. Louis.		Omaha.	
	Inferior to choice.		Good to extra.		Good to choice natives.		Native.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1906.								
January	$3.75	$6.25	$4.50	$5.50	$5.75	$6.25	$4.00	$4.60
February	3.50	6.25	4.35	5.50	5.50	6.25	3.50	6.25
March	3.50	6.50	5.00	5.75	5.50	6.45	2.75	6.00
April	3.50	6.50	4.00	5.75	5.50	6.00	3.25	6.15
May	3.75	6.50	4.10	4.75	6.00	6.25	4.50	6.40
June	3.50	6.25	4.40	5.25	6.00	6.10	3.80	6.50
July	3.00	6.25	4.10	4.75	5.25	5.75	4.00	6.25
August	3.00	5.60	4.10	4.75	5.00	5.50	4.50	5.85
September	3.50	5.75	4.10	4.75	5.35	5.75	4.25	5.85
October	3.50	5.75	3.85	4.75	5.35	5.50	4.75	5.65
November	3.25	5.75	4.00	4.00	5.50	5.60	4.50	6.10
December	3.00	7.00	4.00	4.75	5.50	6.00	4.75	6.35

Wool product of the United States for 1906, by States.

[Estimate of National Association of Wool Manufacturers.]

State or Territory.	Number of sheep Apr. 1, 1906.	Average weight of fleece, 1906.	Per cent of shrinkage, 1906.	Wool, washed and unwashed.	Wool, scoured.
		Pounds.	*Per cent.*	*Pounds.*	*Pounds.*
Maine	200,000	6	40	1,200,000	720,000
New Hampshire	63,000	6.2	50	390,600	195,300
Vermont	160,000	6	51	960,000	470,400
Massachusetts	26,000	5.8	42	150,800	87,464
Rhode Island	6,500	5.5	42	35,750	20,735
Connecticut	26,000	5.5	42	143,000	82,940
New York	725,000	6	50	4,350,000	2,175,000
New Jersey	32,000	5.5	50	176,000	88,000
Pennsylvania	850,000	6	50	5,100,000	2,550,000
Delaware	6,500	6	50	39,000	19,500
Maryland	100,000	5	45	500,000	275,000
Virginia	350,000	5	38	1,750,000	1,085,000
West Virginia	480,000	5.5	48	2,640,000	1,372,800
North Carolina	205,000	4.25	42	871,250	505,325
South Carolina	50,000	4	42	200,000	116,000
Georgia	250,000	3.8	40	950,000	570,000
Florida	105,534	3	40	316,602	189,961
Ohio	1,850,000	6.25	50	11,562,500	5,781,250
Indiana	800,000	6.25	45	5,000,000	2,750,000
Illinois	550,000	6.5	48	3,575,000	1,859,000
Michigan	1,500,000	6.3	50	9,450,000	4,725,000
Wisconsin	800,000	6.75	48	5,400,000	2,808,000
Minnesota	350,000	7	52	2,450,000	1,176,000
Iowa	500,000	6.5	50	3,250,000	1,625,000
Missouri	714,264	6.45	48	4,607,003	2,395,642
North Dakota	375,000	6.5	61	2,437,500	950,625
South Dakota	575,000	6.5	60	3,737,500	1,495,000
Nebraska	250,000	7.5	67	1,875,000	618,750
Kansas	170,000	7.5	67	1,275,000	420,750
Kentucky	575,000	4.75	38	2,731,250	1,693,375
Tennessee	275,000	4.25	40	1,116,875	670,125
Alabama	175,000	3.25	40	568,750	341,250
Mississippi	165,000	4	42	660,000	382,800
Louisiana	155,000	3.7	42	573,500	332,630
Texas	1,440,000	6.5	66	9,360,000	3,182,400
Indian Territory Oklahoma	60,000	6	67	360,000	118,800
Arkansas	200,000	4.5	41	900,000	531,000
Montana	4,940,000	7.25	65	35,815,000	12,535,250
Wyoming	4,531,000	7.25	68	32,849,750	10,511,920
Colorado	1,400,000	6.75	67	9,450,000	3,118,500
New Mexico	2,900,000	5.5	62	15,950,000	6,061,000
Arizona	680,000	6.5	66	4,420,000	1,502,800
Utah	1,900,000	6.5	65	12,350,000	4,322,500
Nevada	650,000	8	69	5,200,000	1,612,000
Idaho	2,300,000	7.35	67	16,905,000	5,578,650
Washington	575,000	8.5	70	4,887,500	1,466,250
Oregon	1,800,000	8.5	70	15,300,000	4,590,000
California	1,750,000	7.5	67	13,125,000	4,331,250
United States	38,540,798	6.66	61.08	256,915,130	100,010,942
Pulled wool			30	42,000,000	29,400,000
Total product, 1906				298,915,130	129,410,942

Wholesale prices of wool per pound in leading cities of the United States, 1902–1906.

Date.	Boston. XX Ohio, washed. Low.	Boston. XX Ohio, washed. High.	New York. XX Ohio. Low.	New York. XX Ohio. High.	Philadelphia. XX Ohio, washed. Low.	Philadelphia. XX Ohio, washed. High.	St. Louis. Best tub-washed. Low.	St. Louis. Best tub-washed. High.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1902.								
January	27	27	26	27	26	27	24	24½
February	27	27	26	27	26	27	24½	24½
March	27	27	26	27½	26	27	24	24
April	27	27	26½	27½	26	27	24	24
May	27	27	26½	27½	26	27	24	25
June	27	27½	26½	27½	26	27	24	25
July	27	28	26½	27½	26½	27½	24	25½
August	28	28	26½	27½	27½	28	25½	26½
September	29	29	26½	27½	27	29	26	26½
October	30	30	....	....	27	29	26	27
November	29	31	28	29	29	30	27½	28½
December	32	32	30	32	31	32	28	29
1903.								
January	32	32½	31	32	31	32	29	29
February	31	33	31	32	31	32	29	29
March	31	32	31	32	31	32	28	29
April	31	32	31	32	31	32	27	28½
May	30	32	30	33	31	32	27	28½
June	31	34	30	31	30	31	28	29
July	33	34	30	31	32	33	29	29½
August	33	35	31	33	32	33	29	29½
September	34	35	28	32	32	33	30	30
October	34	35	28	32	33	34	30	30½
November	34	35	28	32	33	34	30½	31
December	34	35	28	32	33	34	30½	30½
1904.								
January	33½	34	28	32	33	33	30½	30½
February	33	34	28	32	33	33	30½	31
March	33	34	28	32	33	33	30½	31
April	32	34	28	32	33	33	30½	31
May	32	33	28	32	32½	32½	30½	32
June	32	34	28	32	31½	31½	32	33
July	34	35	28	35	31½	33	33	34½
August	34	35	32	35	33	33	35	35
September	34	35	34	35	33	33	35	36
October	34	35	32	35	33	33	34½	36½
November	35	36	32	35	33	33½	37	40
December	34	36	32	35	33½	33½	40	41
1905.								
January	34	35	32	35	34	36	40	41
February	34	35	32	35	34	35	39	41
March	34	35	31	34	34	35	37	38
April	34	35	31	36	34	35	37	39½
May	34	36	32	36	34	36	39	43
June	36	37	32	36	34	36	41	42½
July	35	37	32	39	35	36	41	42
August	36	37	35	39	35	36	41½	41½
September	36	37	35	38	35	36	42	42
October	36	37	35	38	34	35	42	42½
November	35	36	34	38	34	35	41	42
December	35	36	35	38	34	35	41	41½
1906.			XX washed.					
January	34	36	35	38	34	35	33	35
February	34	34½	35	38	34	35	31	35
March	34	34½	35	38	34	35	36	38
April	34	34½	35	38	34	35	36	38
May	34	34½	35	38	34	35	38	40
June	34	34½	35	38	34	34½	38	39
July	34	35	35	38	33½	34	38	38½
August	34	35	35	38	33½	34	37	38½
September	34	34½	35	38	33½	34	37	38
October	33½	34½	35	38	33½	34	37	38
November	33½	34	35	38	33	34	37	37½
December	34	34½	35	38	33	34	38	38

Range of prices per pound of wool in Boston, monthly, 1902–1906.[a]

Date	Ohio fine, unwashed.		Indiana quarter-blood, unwashed.		Ohio XX, washed.		Ohio, No. 1, washed.		Ohio Delaine, washed.		Michigan X, washed.[b]	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
January	19½	20	22	22	27	27	27	27	28	29	21	21
February	20	20	22	22	27	27	27	27	28	29	21	21
March	19½	19½	21½	22	27	27	26½	27	28	29	21	21
April	19½	19½	21½	21½	27	27	26½	26½	28	28½	20½	21
May	19	19½	20½	20½	27	27	26	26	28	28½	21	22
June	19	20	20½	21	27	27½	26	26	28	29	22	22
July	20	20	21	22	27	28	26	27	28	31	22	22
August	20	21	22	23	28	28	28	29	30	33	22	23
September	21½	21½	22	23	29	29	29	30	31½	32	23	23
October	21½	21½	23	23	30	30	30	30	31½	32	23	24
November	21½	22	23	23	29	31	30	31	31½	33	24	25
December	23	23	24	24	32	32	31	31	33	35	26	27
1903.												
January	22	23	23½	24	32	32½	31	32	34	35	27	27½
February	22	23	24	25	31	33	31	33	34	35	27	27½
March	22	23	22	24	31	32	31	32	33½	34	26	27
April	20	22	22	23½	31	32	30	31	33½	34	26	26½
May	20	22	22	23½	30	32	29	31	33½	35	25	26
June	21	24	22	25	31	34	30	33	34	37	25	26
July	23	24	23	25	33	34	32	33	36	37	21	22
August	23	25	24	25	33	35	32	33	36	37	21½	22
September	24	25	24	25	34	35	32	33	36	37	21	22
October	24	25	24	25	34	35	32	34	36	37	21	22
November	24	25	24	25	34	35	33	34	35	37	21	22
December	24	25	24	25	34	35	33	34	35	36	21	22
1904.												
January	23	24	24	25	33½	34	32	33	35	36	21	22
February	22	24	24½	25½	33	34	32	33	35	36	20	22
March	22	24	24½	25½	33	34	32	33	35	36	20	21
April	22	23	25	25½	32	34	30	32	34	35	19	21
May	22	23	24	25	32	33	30	32	34	35	19	20
June	22	23	24	27	32	34	30	33	34	36	19	22
July	21	24	27	30	34	35	33	34	35	36	21	22
August	24	25	28	30	34	35	33	34	35½	36	21	22
September	24	25	28	29	34	35	33	34	35½	36	21	22
October	23	25	28	30	34	35	33	35	35½	36	21	22
November	23	25	30	32	35	36	35	38	35½	38	21	22
December	24	25	31	33	34	36	37	40	37	38	21	22
1905.												
January	24	25	31	33	34	35	38	39	37	38	21	22
February	24	25	31	32	34	35	38	39	36	38	21	22
March	23	25	30	32	34	35	36	37	36	37	20	22
April	23	24	30	31	34	35	36	37	36	37	20	21
May	23	27	30	35	34	36	36	38	36	39	20	25
June	26	30	34	36	36	37	37	42	39	40	25	27
July	27	28	33	37	35	37	39	43	38	40	25	26
August	27	28	34	36	36	37	40	42	39	40	25	27
September	27	28	34	35	36	37	40	42	39	40	25	26
October	27	28	34	35	36	37	41	42	37	39	25	26
November	27	28	34	35	35	36	41	42	36½	37	25	26
December	27	28	33	34	35	36	39	42	36½	37	25	26
1906.												
January	26	28	33	34	34	36	39	40	36½	37	25	26½
February	26	26½	32	34	34	34½	39	40	36½	37	26	26½
March	24	26	32	32½	34	34½	39	40	36½	37	24	25
April	24	25	32	32½	34	34½	39	40	36½	37	24	25
May	24	26	32	32½	34	34½	37	40	36½	37	24	25
June	24	25	32	32½	34	34½	37	38	36½	37	24	25
July	24	25	32	34	34	35	37	38	36½	37	24	25
August	24	26	33	34	34	35	40	41	36	37	24	26
September	25	26	33	34	34	34½	40	41	36	37	25	26
October	24	26	30	34	33½	34½	40	41	35½	37	24	26
November	24	25	30	31½	33½	34	40	41	35½	36½	24	25
December	24	25	31	32	34	34½	40	41	36½	37½	24	25

[a] Furnished by Commercial Bulletin, Boston.
[b] Since June 12, 1903, the standard quotation has been Michigan fine unwashed.

Range of prices per pound of wool in Boston, monthly, 1902–1906—Continued.

Date.	Fine selected Territory, staple scoured.		Fine medium Territory, clothing scoured.		Texas, 12 months, scoured.		Fine free fall, Texas or California scoured.		Pulled, A super, scoured.		Pulled, B super, scoured.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.												
January	49	55	44	47	48	50	40	42	38	42	34	36
February	54	55	46	47	48	55	40	45	38	42	36	36
March	50	55	45	46	52	55	40	45	38	42	35	36
April	50	52	44	44	52	53	40	42	38	42	33	33
May	50	52	42	45	48	52	38	40	38	41	33	34
June	48	52	42	44	50	55	38	40	38	42	34	35
July	50	55	45	47	52	57	38	40	38	45	36	38
August	55	57	47	49	55	57	40	40	42	45	39	39
September	55	57	49	49	55	57	40	40	40	45	37	38
October	55	57	49	49	55	57	40	45	40	45	37	37
November	55	58	49	50	55	60	44	48	40	44	37	39
December	58	59	50	50	57	60	46	48	44	46	40	40
1903.												
January	56	60	54	58	57	60	46	48	44	46	40	42
February	55	58	52	56	55	58	45	48	43	46	40	43
March	54	56	52	54	55	57	45	46	42	45	39	42
April	54	55	52	53	55	57	45	46	40	44	39	41
May	52	55	50	53	53	57	45	46	40	45	39	42
June	52	55	50	53	53	57	45	48	42	46	40	42
July	53	55	52	53	55	57	46	48	43	47	40	44
August	54	56	52	53	55	57	46	48	45	47	43	44
September	55	56	52	53	55	57	46	48	44	47	42	44
October	55	56	52	53	55	57	46	48	44	47	42	43
November	53	56	51	53	55	56	45	48	44	47	40	43
December	53	55	51	52	55	56	44	46	43	45	40	42
1904.												
January	50	52	50	52	55	56	45	46	43	47	40	43
February	53	55	50	52	55	56	45	46	44	47	41	43
March	53	55	50	52	54	56	45	46	44	47	41	43
April	53	55	50	52	53	55	44	46	44	47	42	43
May	52	53	50	51	52	53	44	45	45	47	42	44
June	52	58	50	52	52	60	44	45	45	48	43	45
July	58	62	53	60	58	60	44	45	46	49	43	46
August	60	63	58	60	58	60	44	45	48	50	45	48
September	62	65	58	62	58	63	44	47	48	52	47	50
October	63	65	60	62	62	63	45	50	50	54	48	50
November	64	70	60	65	62	63	48	53	54	57	50	53
December	68	70	65	68	62	68	52	56	58	60	52	55
1905.												
January	68	70	62	63	65	68	55	56	58	60	53	55
February	65	70	60	63	63	68	54	56	57	60	52	55
March	65	68	60	62	63	65	54	56	55	60	52	54
April	65	70	60	63	63	68	54	56	55	60	52	54
May	68	74	62	67	67	72	54	56	58	65	52	58
June	73	76	65	70	70	75	54	60	58	62	55	58
July	73	78	67	70	74	76	57	63	58	62	55	58
August	76	78	67	72	74	76	62	63	60	63	56	60
September	76	78	68	72	74	76	62	63	62	63	58	60
October	76	78	68	72	74	76	62	63	62	63	57	60
November	76	78	66	70	74	76	62	63	62	63	55	57
December	76	78	66	70	74	76	62	63	62	63	54	56
1906.												
January	75	78	65	68	74	76	62	63	62	63	53	56
February	75	76	66	68	74	76	62	63	60	63	52	55
March	72	73	66	68	72	73	62	63	60	62	52	55
April	72	73	66	68	72	73	62	63	60	62	52	55
May	72	73	66	68	72	73	62	63	60	64	52	55
June	72	73	66	70	72	73	62	63	60	64	52	55
July	72	75	68	70	72	73	62	63	60	64	52	55
August	73	75	68	70	72	73	62	63	60	64	51	55
September	73	75	68	70	72	73	58	63	60	64	50	55
October	70	75	65	69	72	73	58	60	57	64	49	55
November	70	72	65	67	72	73	58	60	56	60	47	53
December	70	73	66	68	72	73	58	62	53	59	47	53

SWINE.

Number and farm value of swine, with exports, 1867–1907.

Year.	On farms January 1.			Exports for year ended June 30.		
	Number.	Price per head	Farm value.	Number.	Value.	Average price.
1867	24,693,534	$4.[illegible]	$[illegible]	3,577	$40,092	$11.21
1868	24,317,258	[illegible]	[illegible]	1,399	18,447	13.19
1869	[illegible]	[illegible]	[illegible]	....	....	....
1870	[illegible]	[illegible]	[illegible]	12,058	189,753	15.74
1871	29,457,500	5.61	[illegible]	8,779	[illegible]	7.00
1872	[illegible]	4.01	[illegible]	56,110	548,153	9.77
1873	32,632,050	3.67	119,632,880	99,720	787,412	7.90
1874	30,860,900	3.98	122,695,985	158,581	1,625,837	10.25
1875	28,062,200	4.80	134,581,364	64,979	739,215	11.38
1876	25,726,800	6.00	154,251,110	68,044	670,042	9.85
1877	28,077,100	5.66	158,873,410	65,107	699,180	10.74
1878	32,262,500	4.85	156,577,225	29,284	267,259	9.13
1879	34,766,100	3.18	110,507,758	75,129	700,262	9.32
1880	34,034,100	4.28	145,781,515	83,434	421,089	5.05
1881	36,247,603	4.70	170,535,435	77,456	572,138	7.39
1882	44,122,200	5.97	263,543,195	36,368	509,651	14.01
1883	43,270,086	6.75	291,951,221	16,129	272,516	16.90
1884	44,200,893	5.57	246,301,139	46,382	627,480	13.53
1885	45,142,657	5.02	226,401,683	55,025	579,183	10.53
1886	46,092,043	4.26	196,569,894	74,187	674,297	9.09
1887	44,612,836	4.48	200,043,291	75,383	564,753	7.49
1888	44,346,525	4.98	220,811,082	23,755	193,017	8.13
1889	50,301,592	5.79	291,307,193	45,128	356,764	7.91
1890	51,602,780	4.72	243,418,336	91,148	909,042	9.97
1891	50,625,106	4.15	210,193,925	95,654	1,146,630	11.99
1892	52,398,019	4.60	241,031,415	31,963	364,081	11.39
1893	46,094,807	6.41	295,426,492	27,373	397,162	14.51
1894	45,206,498	5.98	270,384,626	1,553	14,753	9.50
1895	44,165,716	4.97	219,501,267	7,130	72,424	10.16
1896	42,842,759	4.35	186,529,745	21,049	227,297	10.80
1897	40,600,276	4.10	166,272,770	28,751	296,068	10.30
1898	39,759,993	4.39	174,351,409	14,411	110,487	7.67
1899	38,651,631	4.40	170,109,743	33,031	227,241	6.88
1900	37,079,356	5.00	185,472,321	51,180	394,813	7.71
1901	56,982,142	6.20	353,012,143	22,318	238,465	10.68
1902	48,698,890	7.03	342,120,780	8,368	88,330	10.56
1903	46,922,624	7.78	364,973,688	4,031	40,923	10.15
1904	47,009,367	6.15	289,224,627	6,345	53,780	8.48
1905	47,320,511	5.99	283,254,978	44,496	416,692	9.36
1906	52,102,847	6.18	321,802,571	59,170	630,998	10.66
1907	54,794,439	7.62	417,791,321	....	....	....

Number, average price, and farm value of swine in the United States on January 1, 1907.

State or Territory.	Number.	Average price per head, Jan. 1.	Farm value.	State or Territory.	Number.	Average price per head, Jan. 1.	Farm value.
Maine	[illegible]	$[illegible]	$643,911	South Dakota	992,250	$8.90	$8,831,025
New Hampshire	51,707	10.00	517,070	Nebraska	4,080,000	8.75	35,700,000
Vermont	95,874	9.00	862,866	Kansas	2,561,200	8.20	21,001,840
Massachusetts	71,157	10.00	711,570	Kentucky	1,212,380	6.00	7,274,280
Rhode Island	13,811	9.90	136,729	Tennessee	1,502,500	5.50	8,263,750
Connecticut	47,427	[illegible]	[illegible]	Alabama	1,251,251	4.70	5,880,880
New York	675,145	9.25	6,245,091	Mississippi	1,316,214	4.75	6,252,016
New Jersey	156,952	11.00	1,726,472	Louisiana	668,786	4.75	3,176,734
Pennsylvania	[illegible]	9.40	[illegible]	Texas	2,860,879	5.60	16,020,922
Delaware	46,491	8.00	371,928	Indian Territory	788,920	6.40	5,049,088
Maryland	[illegible]	[illegible]	[illegible]	Oklahoma	655,173	7.40	4,848,280
Virginia	[illegible]	7.25	[illegible]	Arkansas	1,174,200	4.15	4,872,930
West Virginia	378,750	6.60	2,499,750	Montana	62,891	9.20	578,597
North Carolina	1,291,784	5.30	6,846,455	Wyoming	16,777	8.30	139,249
South Carolina	678,205	5.60	3,797,948	Colorado	124,545	8.80	1,095,996
Georgia	1,582,713	6.00	9,496,278	New Mexico	23,291	7.00	163,037
Florida	399,296	3.30	1,317,677	Arizona	18,355	7.70	141,334
Ohio	[illegible]	8.25	[illegible]	Utah	58,984	7.50	442,380
Indiana	[illegible]	[illegible]	[illegible]	Nevada	15,006	8.00	120,048
Illinois	4,449,705	8.40	37,377,522	Idaho	122,946	8.00	983,568
Michigan	1,334,648	8.45	11,277,776	Washington	172,178	9.00	1,549,602
Wisconsin	1,873,206	8.45	15,828,591	Oregon	258,283	6.90	1,782,153
Minnesota	1,477,900	9.00	13,301,100	California	550,581	7.10	3,909,125
Iowa	[illegible]	[illegible]	[illegible]				
Missouri	3,454,950	7.10	24,530,145	United States	54,794,439	7.62	417,791,321
North Dakota	291,285	8.75	2,548,744				

Wholesale prices of live hogs per 100 pounds in leading cities of the United States, 1902–1906.

Date.	Cincinnati. Packing, fair to good.		St. Louis. Mixed packers.		Chicago.		Omaha.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.								
January	$6.00	$6.50	$6.10	$6.90	$4.40	$6.85	$5.40	$6.70
February	6.05	6.50	5.85	6.50	4.40	6.85	5.25	6.45
March	6.20	6.95	5.80	6.92½	4.75	7.00	5.50	6.75
April	6.75	7.30	6.80	7.50	5.40	7.50	6.20	7.30
May	6.65	7.25	6.70	7.50	5.40	7.50	6.50	7.35
June	6.70	7.70	6.95	7.95	5.65	7.95	6.70	7.75
July	7.25	8.00	7.50	8.15	5.70	8.75	6.85	8.05
August	6.40	7.70	6.70	8.12½	5.30	7.95	6.50	7.65
September	6.90	7.80	7.30	8.20	5.50	8.20	7.05	7.75
October	6.50	7.70	6.40	7.90	4.50	7.90	6.40	7.45
November	5.85	6.60	6.05	6.90	4.60	6.95	5.95	6.55
December	6.05	6.65	5.95	6.70	4.60	6.85	5.75	6.60
1903.								
January	6.25	6.95	6.15	6.95	5.00	7.00	6.00	6.85
February	6.70	7.30	6.60	7.30	5.30	7.55	6.35	7.20
March	7.05	7.75	6.95	7.60	6.00	7.85	6.75	7.55
April	6.70	7.45	6.50	7.40	6.30	7.65	6.60	7.40
May	5.75	6.85	5.80	7.05	5.10	7.15	5.50	6.90
June	5.70	6.25	5.50	6.20	5.25	6.35	5.50	6.20
July	5.15	5.90	5.30	5.95	4.60	6.20	4.90	5.65
August	5.40	6.05	5.20	5.90	4.50	6.15	4.92½	5.80
September	5.80	6.35	5.55	6.20	4.85	6.45	5.05	6.00
October	5.10	6.20	5.30	6.25	4.00	6.50	4.80	5.85
November	4.15	5.35	4.50	5.50	3.75	5.50	4.10	5.25
December	4.25	4.95	4.20	4.85	3.80	4.90	4.15	4.70
1904.								
January	4.75	5.25	4.65	5.25	3.85	5.20	4.20	5.00
February	4.85	5.85	4.70	5.80	3.90	5.80	4.50	5.60
March	5.35	6.00	5.20	5.75	4.00	5.82½	4.60	5.40
April	4.90	5.50	4.75	5.67½	3.75	5.30	4.50	5.17½
May	4.50	5.00	4.55	4.90	3.70	4.95	4.20	4.77½
June	4.55	5.55	4.57½	5.50	4.00	5.47½	4.27½	5.27½
July	5.25	5.95	5.10	5.75	4.70	5.90	4.50	5.37½
August	5.20	5.85	5.10	5.72½	4.60	5.80	4.65	5.40
September	5.55	6.25	5.30	6.25	4.70	6.37½	5.00	6.05
October	5.00	6.10	4.90	6.30	4.40	6.27½	4.92½	5.85
November	4.45	5.20	4.50	5.17½	3.65	5.25	4.45	5.00
December	4.35	4.90	4.25	4.85	3.60	4.87½	4.25	4.65
1905.								
January	4.60	4.95	4.75	5.02	3.90	5.00	4.30	4.85
February	4.80	5.35	4.97	5.20	4.10	5.15	4.40	5.00
March	5.00	5.65	5.25	5.57	4.15	5.55	4.50	5.25
April	5.25	5.80	5.60	5.70	4.50	5.72½	5.10	5.40
May	5.30	5.60	5.40	5.57	4.60	5.65	5.00	5.37½
June	5.30	5.55	5.42	5.65	4.50	5.65	4.90	5.35
July	5.45	6.20	5.75	6.20	4.80	6.15	5.05	5.70
August	5.90	6.35	6.30	6.35	5.25	6.45	5.50	6.10
September	5.15	6.25	5.60	6.00	4.40	6.20	4.85	5.75
October	4.95	5.70	5.15	5.55	4.40	5.80	4.75	5.37½
November	4.80	5.15	4.95	5.12½	4.20	5.25	4.50	5.00
December	4.80	5.45	5.00	5.30	4.50	5.35	4.65	5.00
1906.								
January	5.30	5.80	5.10	5.45	4.60	5.70	4.85	5.50
February	5.65	5.45	5.35	6.20	5.10	6.40	5.25	6.20
March	6.30	6.75	6.10	6.45	5.50	6.55	5.85	6.37½
April	6.35	6.75	6.25	6.65	5.15	6.82½	6.10	6.55
May	6.25	6.62	6.22	6.57	5.10	6.67½	6.10	6.45
June	6.30	6.85	6.20	6.75	5.25	6.85	6.10	6.60
July	6.65	6.95	6.55	6.97	5.60	7.00	6.15	6.75
August	6.00	6.72	6.05	6.67	5.10	6.80	5.45	6.45
September	6.10	6.80	6.12	6.67	5.25	6.80	5.40	6.45
October	6.10	6.80	6.15	6.70	5.16	6.85	5.92½	6.50
November	6.10	6.50	6.07	6.42	5.20	6.50	5.80	6.27½
December	6.10	6.55	5.95	6.45	5.30	6.55	5.90	6.35

EGGS.

Wholesale prices of eggs per dozen in leading cities of the United States, 1902–1906.

Date.	New York. Average best fresh.		Cincinnati.		Chicago. Fresh.		St. Louis. Average best fresh.	
	Low.	High.	Low.	High.	Low.	High.	Low.	High.
1902.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	26	34	22	30	18	28	22	26
February	27	37	21	32	23½	33½	21	32
March	15½	30	13½	23	13¾	26½	13½	26½
April	15½	18	14	15	14	16	13½	15½
May	16	17½	14	15	14½	15½	13½	15
June	17	20	14	14½	14¾	17	13	15½
July	18	20½	14	14½	17	18	11¼	14½
August	18	21	14	16	16	18	13	16
September	20	24	16½	18½	17	20½	15	20
October	21	25	18	21	20	22	17	18½
November	22	26	19	23	21½	24	19½	22½
December	24	29	21	23	20	25	20½	22½
1903.								
January	24	28	20	26	21	26½	17½	22½
February	16	25	12	20	14	20	12½	18
March	14½	21	12	16½	12½	20	11	16½
April	15	17½	12	14	12½	15½	11	14¼
May	16	19	13½	14	13	15	12¼	14
June	17½	19½	13½	14	12½	15½	12½	15
July	18½	23	12	14	11	16	11	12½
August	15½	26	12½	18	10	19	14	19
September	19	28	18	19	16	20	18½	19
October	21	33	19	22	17	23	19	21½
November	22	45	20	28	18	28	21½	26
December	28	45	20	26	22	30	24	28½
1904.								
January	27	47	23	32	22	34½	28	29
February	20	40	19	29	18	33½	17¾	29
March	16	25	14½	20	14¾	20	13¼	16
April	17	21	15½	17	15½	18½	14½	15½
May	17	21	15	17	14	18	13	15½
June	17½	21	15½	16	13	17½	14½	15½
July	17½	24	15½	16	11	20	13	17½
August	19	26	15	18	11	20½	16	19½
September	20	30	16	19	13	22	17½	20½
October	20	30	18	20	13	23½	19	20½
November	21	38	21	26	17	28	21½	27
December	20	40	22	27	16	30	24	27
1905.								
January	22	40	22	27	18	31	22	29
February	24	40	24	30	20	36	28	34
March	17	40	14½	23	14½	31	14	22½
April	17½	21	15	16	14½	19	14½	15½
May	17½	21	15	16	14	18½	12½	16½
June	16½	22	14½	15	12	17½	14	15½
July	16½	25	14	14½	12	20½	10½	14
August	18	28	14	17	12½	22	14	16½
September	20	30	17	19	13	22½	16½	16½
October	21	35	18½	23	15	25	16½	19
November	25	40	23	28	16	30	19	24
December	26	40	24	27	18	31	22½	24
1906.								
January	17½	34	16	24	16	27	14	22
February	15½	27	13	17	11	21½	11½	17
March	14½	22	13	13½	12	17	12	15
April	17	22	14	16½	14	19½	13½	16
May	16	21	14	14½	12	18½	13	14
June	17	23	14	14½	12	19	15	17
July	17	25	14	15½	12	18½	12½	13
August	18	28	14½	18	12	20½	13	15
September	21	33	19	21	12	24½	15	17½
October	20	35	22	24	15	27	18	22
November	20	42	28	29	20	32	20	26
December	22	45	25	29	20	36	21	26

TRANSPORTATION RATES.

Quotations of ocean freight rates on corn, wheat, cotton, and lard from United States ports to Liverpool during 1906.

Article and port.	Mean for month.												Mean for year.
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Corn and wheat (per 60 lbs.):	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Boston	5.25	4.07	3.36	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.15	3.42
New York	4.72	4.07	3.26	2.89	2.76	2.20	2.43	3.15	3.04	3.28	2.63	2.84	3.11
Baltimore	5.51	3.94	3.68	3.41	3.41	2.10	3.68	4.33	6.17	3.41	3.94	4.73	4.03
New Orleans	7.75	6.82	6.30	6.30	6.30	6.30	6.30	6.51	7.22	7.35	7.74	7.48	6.86
Galveston	6.75	6.38	6.00	6.00	6.00	6.00	6.00	6.00	7.50	7.62	7.62	7.31	6.60
Cotton (per 100 lbs.):													
Boston	17.00	14.75	12.80	11.00	11.00	10.25	10.25	13.60	15.00	14.00	12.80	12.00	12.87
New York	19.00	18.00	18.00	16.00	15.00	14.60	13.50	16.00	18.40	22.50	18.00	17.80	17.23
Baltimore	25.00	21.50	15.20	15.00	12.00	12.00	12.00	16.00	21.00	22.00	22.00	22.00	17.98
New Orleans	35.50	33.00	32.00	30.00	29.20	28.00	26.00	30.00	34.33	39.40	40.00	37.50	32.91
Galveston	35.65	30.58	30.00	29.12	28.25	27.00	25.92	29.67	35.00	38.64	40.69	38.71	32.44
Lard, small packages (per 100 lbs.):													
Boston	19.69	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	17.11
New York	18.98	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88	17.06
Baltimore	21.09	19.69	19.69	19.69	18.28	18.28	18.28	18.28	18.28	18.28	18.28	18.28	18.87
New Orleans	27.00	27.00	25.67	23.00	23.00	23.00	23.00	23.40	25.00	25.00	25.00	25.00	24.59
Galveston	20.00	18.00	18.00	18.00	18.00	17.00	17.00	17.00	19.00	21.50	21.50	20.00	18.75

Live stock and dressed meats, Chicago to New York by rail: Mean rates, in cents, per 100 pounds.

Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs.		Year.	Cattle.	Hogs.	Sheep.	Horses and mules.	Dressed beef.	Dressed hogs.	
						Refrigerator cars.	Common cars.							Refrigerator cars.	Common cars.
1882	36	29	53	60	57			1895	28	30	30	60	45	45	45
1883	40	32	50	60	64			1896	28	30	30	60	45	45	45
1884	31	28	44	60	51			1897	28	30	30	60	45	45	45
1885	31	26	43	60	54			1898	28	30	30	60	45	45	45
1886	33	30	42	60	61	53	48	1899[a]	25	25	25	60	40	40	40
1887	33	32	40	60	62	59	54	1900	28	30	30	60	45	45	45
1888	22	26	31	60	46	46	44	1901	28	30	30	60	42.9	42.9	42.9
1889	25	30	30	60	47	47	45	1902	28	30	30	60	41.2	41.2	41.2
1890	23	28	30	60	39	39	39	1903	28	30	30	60	45	45	45
1891	27	30	30	60	45	45	45	1904	28	30	30	60	45	45	45
1892	28	28	30	60	45	45	45	1905	28	30	30	60	45	45	45
1893	28	20	30	60	45	45	45	1906	28	30	30	60	45	45	45
1894	28	30	30	60	45	45	45								

[a] Rates did not go into effect until February 1, 1899. Until that time the 1898 rates governed.

Meats, packed, Cincinnati to New York by rail: Mean rates, in cents, per 100 pounds.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	The year.
1880	39	39	39	34.5	30.5	30.5	30.5	30.5	30.5	30.5	31.5	35	33.41
1881	35	35	35	30.5	30.5	25.7	21.5	21.5	21.5	21.5	21.5	21.5	26.73
1882	......	21.5	24.3	26	26	26	26	26	26	26	26	30.5	25.85
1883	30.5	30.5	30.5	29.2	26	26	26	26	26	26	26.7	30.5	27.83
1884	30.5	30.5	23.3	17.5	17.5	18.4	23	26	26	26	26	26	24.22
1885	24.4	21.5	20	20.6	18.5	17.5	17.5	21.5	21.5	21.5	22.8	26	21.10
1886	26	26	26	26	26	26	26	26	26	26	26	27.7	26.14
1887	30.5	30.5	30.5	26	26	26	26	26	26	26	26	26	27.12
1888	28	28.5	26.3	26	26	26	19.9	17.3	15.5	18.8	21.5	23.6	23.11
1889	26	26	26	26	26	26	26	26	26	26	26	26	26
1890	26	26	26	26	26	26	26	24.8	20	20	20	20	23.89
1891	20	24.3	26	26	26	26	26	26	26	26	26	26	25.36
1892	26	26	26	26	26	25.7	21.5	21.5	21.5	21.5	21.5	21.5	23.70
1893	21.5	23.7	26	26	26	26	26	26	26	26	26	26	25.43
1894	26	26	26	26	26	26	26	26	26	26	26	26	26
1895	26	26	26	26	26	26	26	26	26	26	26	26	26
1896	26	26	26	26	26	26	26	26	26	26	26	26	26
1897	26	26	26	26	26	26	26	26	26	26	26	26	26
1898	26	26	26	26	26	26	26	26	26	26	26	26	26
1899	26	26	26	26	26	26	26	26	26	21.5	21.5	21.5	24.83
1900	26	26	26	26	26	26	26	26	26	26	26	26	26
1901	26	26	26	26	26	26	26	26	26	26	26	26	26
1902	26	26	26	26	26	26	26	26	26	26	26	26	26
1903	26	26	26	26	26	26	26	26	26	26	26	26	26
1904	26	26	26	26	26	26	26	26	26	26	26	26	26
1905	26	26	26	26	26	26	26	26	26	23	21.5	21.5	25
1906	26	26	26	26	26	26	26	26	26	26	26	26	26

Compressed cotton, by rail: Mean rates, in cents, per 100 pounds.

Year.	From New Orleans[a] to—				From Memphis to—		Year.	From New Orleans[a] to—				From Memphis to—	
	Boston.	New York.	Philadelphia.	Baltimore.	New York.	Boston.		Boston.	New York.	Philadelphia.	Baltimore.	New York.	Boston.
1883	60	55	53	52	72	77	1895	53	48	48	48	50.5	55.5
1884	60	55	53	52	54	59	1896	55	50	50	50	50.5	55.5
1885	60	55	53	52	56	58	1897	55	50	50	50	50	55
1886	52	47	45	44	53	58	1898	55	50	50	50	47	52
1887	50	45	43	42	53	58	1899	52	47	47	47	48	53
1888	50	45	43	42	47	52	1900	55	50	50	50	50.5	55.5
1889	52	47	45	44	50.5	55	1901	55	50	50	50	50.5	55.5
1890	55	50	50	50	50.5	55	1902	55	50	50	50	50.5	55.5
1891	55	50	50	50	50.5	55	1903	55	50	50	50	50.5	55.5
1892	55	50	50	50	50.5	55	1904	55	50	50	50	50.5	50.5
1893	55	50	50	50	47	52	1905	55	50	50	50	40.5	45.5
1894	51	50	50	50	50.5	55.5	1906	50	50	50	50	40.5	45.5

[a] These rates are mainly used for basing purposes.

Corn and wheat: Mean proportional export freight rates per 100 pounds from Kansas City and Omaha to leading Gulf and Atlantic ports during the calendar years 1905 and 1906.

Destination and article.	From Kansas City.		From Omaha.	
	1905.	1906.	1905.	1906.
New Orleans:	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Corn	14.8	[a] 16.5	15.8	[a] 17.5
Wheat	[b] 16.1	[a] 17.1	[b] 17.4	[a] 18.1
Galveston:				
Corn	14.8	16.5	15.8	17.5
Wheat	[b] 16.1	17.1	[b] 17.4	18.1
Boston: [c]				
Corn	22.2	23.4	22.2	23.4
Wheat	[d] 25.0	[e] 21.5	[d] 25.0	[e] 21.5
New York: [c]				
Corn	22.2	23.4	22.2	23.4
Wheat	[d] 25.0	[e] 21.5	[d] 25.0	[e] 21.5
Philadelphia: [c]				
Corn	21.2	22.4	21.2	22.4
Wheat	[d] 24.0	[e] 20.5	[d] 24.0	[e] 20.5
Baltimore: [c]				
Corn	20.7	21.9	20.7	21.9
Wheat	[d] 23.5	[e] 20.0	[d] 23.5	[e] 20.0

[a] From April 25 to August 10, 1906, inclusive, rates used in computing this average include delivery on board ship.
[b] For July 25 to December 31, 1905, inclusive.
[c] Rates include delivery on board ship.
[d] For second half of 1905 only.
[e] Average based upon rates in force for two periods, amounting together to about 30 days.

Corn and wheat: Mean rates, in cents, per bushel, Chicago to New York.

Year.	Corn.			Wheat.		
	By lake and canal.[a]	By lake and rail.	By all rail.	By lake and canal.[a]	By lake and rail.	By all rail.
1875	....	11.34	19.5	....	12.09	20.89
1876	8.75	9.68	14.12	9.82	10.19	15.12
1877	9.59	13.42	18.03	11.09	14.75	19.56
1878	8.83	10.45	16.39	9.96	11.99	17.56
1879	10.49	12.2	14.56	11.87	13.13	17.74
1880	13.41	14.43	17.48	13.13	15.8	19.8
1881	7.77	9.42	13.4	8.67	10.49	14.4
1882	6.72	10.28	13.5	7.23	10.91	14.47
1883	8.03	11	15.12	9.01	11.63	16.2
1884	6.55	8.5	12.32	7	10	13.2
1885	6.3	8.01	12.32	6.54	9.02	13.2
1886	8.45	11.2	14	9.10	12	15
1887	8.5	11.2	14.7	9.5	12	15.75
1888	6.71	10.26	13.54	7.05	11.14	14.5
1889	6.32	8.19	12.6	6.92	8.97	15
1890	5.93	7.32	11.36	6.76	8.52	14.3
1891	6.32	7.53	14	6.95	8.57	15
1892	5.95	7.21	12.96	6.45	7.59	13.8
1893	7.18	7.97	13.65	7.66	8.48	14.63
1894	4.93	6.5	12.32	5.11	7	13.2
1895	4.50	6.4	10.29	4.86	6.96	11.89
1896	5.75	6.15	10.5	6.19	6.61	12
1897	4.53	6.92	11.43	5.22	7.42	12.5
1898	[b] 3.81	4.41	9.8	[b] 4.45	4.91	12
1899	[b] 5.08	5.83	10.08	[b] 5.81	6.63	11.6
1900	[b] 4.07	4.72	9.19	[b] 4.49	5.1	9.96
1901	[b] 4.61	5.16	9.21	[b] 5.11	5.54	9.88
1902	[b] 4.83	5.51	9.94	[b] 5.26	5.89	10.62
1903	[b] 4.85	5.78	10.54	[b] 5.4	6.37	11.29
1904	[b] 3.63	4.82	10.38	[b] 4.73	5.50	11.12
1905	[b] 4.76	5.19	9.40	[b] 5.53	6.40	9.90
1906	[b] 5.51	5.72	9.52	[b] 6.03	6.35	10.20

[a] Including Buffalo charges and tolls. [b] Excluding Buffalo charges.

Average freight rates, in cents, per ton per mile.

Year.[a]	Fitchburg R. R.	Boston and Albany R. R.	New York Central and Hudson River R. R.	Erie R. R.	Lake Shore and Michigan Southern Rwy.	Pennsylvania R. R.	Pittsburg, Fort Wayne and Chicago Rwy.	Chesapeake and Ohio Rwy.	Illinois Central R. R.	Chicago, Rock Island and Pacific Rwy.	Chicago, Milwaukee and St. Paul Rwy.	Chicago and Alton Rwy.	Union Pacific Rwy.	Louisville and Nashville R. R.	All railways in the United States.
1875....	3.024	1.346	1.119	1.061	0.887	0.989	0.970	1.299	1.691	1.088	1.833	1.649	2.164	1.687	1.421
1876....	2.218	1.139	.929	.972	.722	.841	.827	1.062	1.587	1.093	1.798	1.468	2.211	1.638	1.217
1877....	1.955	1.136	.954	.898	.813	.954	1.024	1.035	1.719	1.566	1.949	1.361	2.135	1.382	1.286
1878....	1.582	1.113	.919	.960	.724	.914	.867	.985	[illegible]	1.539	1.762	1.354	2.236	1.635	1.296
1879....	1.299	1.100	.793	.779	.641	.823	.754	.890	1.523	1.429	1.704	1.054	1.991	1.528	1.153
1880....	1.39	1.207	.879	.836	.750	.918	......	.866	1.543	1.209	1.749	1.208	......	1.564	1.232
1881....	1.26	1.038	.783	.805	.617	.857	.745	.892	1.522	1.220	1.792	1.241	2.178	1.505	1.188
1882....	1.17	1.064	.758	.749	.628	.874	.752	.753	1.417	1.281	1.481	1.253	2.102	1.349	1.102
1883....	1.19	1.197	.915	.780	.728	.881	.787	.722	1.433	1.170	1.391	1.128	1.913	1.323	1.205
1884....	1.09	1.093	.834	.719	.652	.804	.673	.672	1.368	1.097	1.293	1.008	1.557	1.344	1.136
1885....	1.06	.944	.688	.656	.553	.695	.577	.550	1.307	1.043	1.278	1.009	1.420	1.159	1.011
1886....	1.07	1.101	.765	.659	.639	.755	.692	.541	1.157	1.071	1.168	.961	1.266	1.079	.999
1887....	1.13	1.107	.782	.687	.670	.730	.717	.537	1.087	1.012	1.089	.946	1.213	1.075	.984
1888....	1.116	1.099	.753	.716	.861	.723	.660	.541	1.068	.964	1.020	.973	1.170	1.049	1.001
1889....	1.015	1.030	.712	.644	.632	.685	.69	.538	.839	.971	1.067	.525	1.166	.998	.922
1890....	.995	1.105	.730	.665	.644	.661	.69	.561	.942	.995	.995	.898	1.138	.972	.941
1891....	.991	1.089	.740	.636	.630	.656	.70	.525	.934	1.039	1.003	.980	1.131	.968	.895
1892....	.925	1.057	.699	.614	.602	.647	.67	.518	.908	1.055	1.026	.973	1.080	.948	.898
1893....	.923	1.006	.701	.631	.599	.620	.68	.511	.845	1.039	1.026	.949	1.033	.917	.878
1894....	.895	.944	.733	.621	.587	.606	.65	.478	.839	.989	1.037	.974	.970	.876	.860
1895....	.878	.909	.726	.604	.567	.565	.64	.425	.808	1.084	1.075	.994	.971	.831	.839
1896....	.864	.942	.668	.606	.551	.563	.66	.425	.745	1.017	1.003	.925	.957	.806	.806
1897....	.870	.918	.679	.610	.538	.561	.60	.419	.671	.958	1.008	.891	.962	.791	.798
1898....	.844	.839	.606	.575	.530	.521	.57	.369	.695	.966	.972	.866	.950	.745	.753
1899....	.771	.778	.586	.539	.481	.469	.50	.362	.688	.996	.937	.800	1.016	.727	.724
1900....	.798	.824	.558	.588	.490	.504	.58	.343	.650	.987	.930	.794	1.050	.752	.729
1901....	(b)	.831	.575	.615	.489	.562	.56	.388	.619	1.000	.871	.723	1.042	.772	.750
1902....	(b)	(c)	.632	.664	.503	.590	.61	.402	.622	1.034	.849	.678	.979	.744	.757
1903....	(b)	(c)	.634	.637	.519	.598	.62	.475	.591	1.013	.865	.599	.973	.781	.763
1904....	(b)	(c)	.664	.652	.523	.606	.60	.470	.607	.944	.891	.677	.982	.791	.780
1905....	(b)	(c)	.638	.645	.524	.604	.61	.427	.587	.931	.881	.689	.897	.793	.766

[a] Beginning with 1888, the years mentioned end on June 30; prior to 1888 they cover different periods for different railways.
[b] Leased by the Boston and Maine Railroad.
[c] Leased by the New York Central and Hudson River Railroad.

Average rates, in cents, per passenger per mile.

Year.[a]	Fitchburg R. R.	Boston and Albany R. R.	New York Central and Hudson River R. R.	Erie R. R.	Lake Shore and Michigan Southern Rwy.	Pennsylvania R. R.[b]	Pittsburg, Fort Wayne and Chicago Rwy.	Chesapeake and Ohio Rwy.	Illinois Central R. R.	Chicago, Rock Island and Pacific Rwy.	Chicago, Milwaukee and St. Paul Rwy.	Chicago and Alton Rwy.	Union Pacific Rwy.	Louisville and Nashville R. R.	All railways in the United States.
1875....	1.910	2.180	1.885	1.955	2.088	2.259	2.407	3.231	2.882	2.687	2.690	2.755	2.878	3.219	2.378
1876....	1.864	2.099	1.693	1.859	1.846	1.819	1.830	3.322	2.804	2.626	2.805	2.614	2.974	3.018	2.183
1877....	1.947	2.174	1.953	1.772	2.182	2.185	2.192	3.786	2.942	2.772	2.994	2.798	3.140	3.167	2.458
1878....	1.969	2.217	1.978	2.158	2.255	2.277	2.258	3.738	3.122	2.933	3.029	2.795	3.226	3.345	2.573
1879....	1.888	2.137	2.044	2.090	2.221	2.253	2.228	3.630	3.066	2.971	2.908	2.417	......	3.444	2.484
1880....	1.885	2.096	1.999	2.041	2.135	2.222	2.156	2.959	2.514	2.806	2.868	2.076	......	3.476	2.442
1881....	1.820	1.970	1.862	2.016	1.988	2.152	1.895	2.989	2.164	2.666	2.856	1.828	3.341	3.168	2.446
1882....	1.715	1.993	1.808	1.948	2.156	2.249	2.024	2.605	2.388	2.505	2.579	1.951	3.300	2.706	2.391
1883....	1.790	2.088	1.986	1.673	2.196	2.297	2.193	2.373	2.424	2.504	2.516	2.141	3.128	2.614	2.402
1884....	1.651	1.908	1.942	2.189	2.170	2.258	2.222	2.379	2.225	2.572	2.553	1.900	2.952	2.342	3.323
1885....	1.833	1.838	1.419	1.756	2.058	1.950	1.569	2.270	2.211	2.466	2.563	2.026	2.749	2.103	2.216
1886....	1.756	1.853	1.845	1.890	2.098	2.114	2.130	2.131	2.208	2.420	2.415	2.023	2.135	2.436	2.142
1887....	1.89	1.880	1.989	2.039	2.260	2.125	2.255	2.074	2.268	2.328	2.538	2.062	2.301	2.394	2.245
1888....	1.978	1.976	1.967	1.851	2.280	2.111	2.10	2.025	2.197	2.312	2.445	2.123	2.248	2.429	2.349
1889....	1.957	1.869	1.932	1.722	2.286	2.076	2.18	1.709	1.927	2.285	2.415	2.128	2.135	2.370	2.165
1890....	1.915	1.858	1.910	1.584	2.254	2.094	2.25	2.056	2.022	2.149	2.359	2.004	2.045	2.403	2.167
1891....	1.869	1.818	1.905	1.601	2.105	2.070	2.23	2.155	2.073	2.322	2.408	2.205	2.059	2.483	2.142
1892....	1.916	1.828	1.887	1.589	2.183	2.028	2.00	2.181	2.101	2.308	2.464	2.043	2.104	2.448	2.126
1893....	1.869	1.835	1.832	1.551	2.195	1.968	1.98	1.989	1.999	2.095	2.414	1.981	1.987	2.432	2.108
1894....	1.851	1.794	1.857	1.509	2.069	1.993	2.00	1.905	1.925	1.891	2.191	1.776	1.758	2.365	1.986
1895....	1.819	1.770	1.837	1.560	2.215	1.971	2.06	1.980	1.995	2.146	2.411	2.119	1.962	2.318	2.040
1896....	1.769	1.752	1.838	1.641	2.148	1.950	1.88	1.952	1.979	2.108	2.375	2.117	2.075	2.187	2.019
1897....	1.811	1.754	1.842	1.543	2.108	1.958	2.02	1.980	1.979	2.153	2.289	2.116	2.101	2.254	2.022
1898....	1.826	1.750	1.80[illegible]	1.548	2.032	1.953	2.02	1.943	1.938	2.092	2.362	2.058	1.945	2.152	1.973
1899....	1.800	1.744	1.766	1.536	2.074	1.937	2.02	1.860	2.014	2.036	2.337	2.055	1.941	2.243	1.925
1900....	1.805	1.754	1,793	1.540	2.223	1.952	2.05	1.973	2.021	2.064	2.346	1.908	1.968	2.318	2.003
1901....	(c)	1.742	1.799	1.541	1.993	1.992	2.09	1.984	1.960	2.095	2.324	1.936	2.085	2.355	2.013
1902....	(c)	(d)	1.723	1.531	1.828	1.999	2.04	2.023	1.999	2.135	2.317	1.860	2.007	2.319	1.986
1903....	(c)	(d)	1.773	1.500	2.066	2.015	2.05	2.044	1.971	2.157	2.309	1.981	1.941	2.369	2.006
1904....	(c)	(d)	1.761	1.452	2.067	2.020	2.03	2.072	1.970	2.203	2.305	1.948	1.907	2.387	2.006
1905....	(c)	(d)	1.719	1.464	2.055	2.000	2.05	2.019	1.839	2.135	2.373	1.730	2.231	2.292	1.962

[a] Beginning with 1888, the years mentioned end on June 30; prior to 1888 they cover different periods for different railways.
[b] Excludes ferry earnings at Jersey City, N. J., at least since 1891.
[c] Leased by the Boston and Maine Railroad.
[d] Leased by the New York Central and Hudson River Railroad.

Mean rates on grain, flour, and provisions, in cents per 100 pounds, through from Chicago to European ports, by all rail to seaboard and thence by steamers, from 1897 to 1906.

Shipped to—	Articles.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Liverpool....	Grain..........	33.6	34.35	29.72	29.48	21.47	20.85	22.68	20.19	19.16	18.75
Do.......	Sacked flour..	36.81	37.66	30.12	27.9	23.00	23.5	25.19	21.00	22.40	20.50
Do.......	Provisions....	44.4	47.15	40.5	48.84	36.00	36.25	41.9	36.56	38.49	41.00
Glasgow......	Grain..........	35.23	36.00	32.35	30.98	24.1	21.75	24.43	22.38	20 00	19.25
Do.......	Sacked flour..	39.06	39.06	31.25	31.56	24.38	22.75	25.38	23.20	22.50	23.60
Do.......	Provisions....	52.5	52.5	44.69	55.31	45.16	41.88	46.88	44.06	43.23	45.63
London.......	Grain..........	34.00	35.00	30.6	31.1	23.23	21.75	23.56	21.50	20.23	19.25
Do.......	Sacked flour..	36.12	37.25	33.5	35.01	25.5	24.00	25.19	22.25	23.64	22.50
Do.......	Provisions....	48.14	49.69	44.14	55.87	44.75	39.06	44.06	44.06	40.88	46.26
Antwerp......	......do.........	51.09	52.5	47.5	51.09	46.25	41.5	49.69	48.28	43.70	47.61
Hamburg......	......do.........	51.00	52.00	46.00	50.00	44.00	39.00	47.00	46.00	45.75	49.00
Amsterdam..	......do.........	52.00	52.5	47.00	51.00	45.00	40.00	42.00	42.00	45.42	46.00
Rotterdam...	......do.........	52.00	52.5	47.00	51.00	45.00	40.00	42.00	42.00	44.53	46.00
Copenhagen..	......do.........	57.28	58.13	51.72	55.31	47.75	42.00	49.69	46.88	48.66	51.00
Stockholm...	......do.........	68.53	69.25	62.97	64.5	53.25	45.00	52.5	49.69	51.47	53.50
Stettin.......	......do.........	57.28	58.13	51.72	55.31	47.75	42.00	49.69	46.88	48.18	50.00
Bordeaux....	......do.........	64.13	65.75	59.12	64.12	54.25	51.25	56.25	56.25	51.45	53.00

IMPORTS AND EXPORTS OF AGRICULTURAL PRODUCTS.[a]

[Compiled by the Division of Foreign Markets, Bureau of Statistics, Department of Agriculture.]

Agricultural imports of the United States during the five years ending June 30, 1906.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle—										
For breeding purposes, number	1,928	$375,096	1,481	$225,875	684	$79,986	2,314	$93,084	829	$118,368
Other ... number	94,099	1,233,626	64,694	935,673	15,372	230,751	25,541	365,488	28,190	430,062
Total cattle ... do	96,027	1,608,722	66,175	1,161,548	16,056	310,737	27,855	458,572	29,019	548,430
Horses—										
For breeding purposes, number	2,944	1,273,607	2,803	1,191,611	2,634	1,090,596	2,853	1,169,011	3,377	1,266,987
Other ... number	1,888	303,627	2,196	344,685	2,092	369,691	2,327	422,072	2,644	449,688
Total horses ... do	4,832	1,577,234	4,999	1,536,296	4,726	1,460,287	5,180	1,591,083	6,021	1,716,675
Sheep—										
For breeding purposes, number	2,059	46,663	1,737	38,037	1,253	23,298	2,200	45,319	2,679	53,951
Other ... number	264,894	910,047	299,886	998,897	236,841	791,961	184,742	659,402	228,068	966,408
Total sheep ... do	266,953	956,710	301,623	1,036,934	238,094	815,259	186,942	704,721	230,747	1,020,359
All other, including fowls		481,865		799,067		543,296		583,078		628,958
Total live animals		4,624,531		4,533,845		3,129,609		3,337,454		3,914,422
Beeswax ... pounds	408,706	115,937	488,576	127,290	475,168	116,878	373,569	101,121	587,617	168,014
Cochineal ... do	138,824	24,865	112,714	24,215	162,362	64,246	84,332	36,876	111,007	53,446
Dairy products:										
Butter ... pounds	453,978	80,725	207,007	51,564	154,457	34,764	503,104	124,136	106,642	57,955
Cheese ... do	17,067,714	2,551,366	20,671,384	3,183,224	22,707,103	3,284,811	23,095,705	3,379,600	27,286,866	4,303,830
Milk		33,457		42,696		32,931		23,014		10,858
Total		2,665,548		3,277,484		3,352,506		3,526,750		4,372,643

Eggs ....dozens..	384,070	37,432	368,482	29,757	496,825	61,458	352,303	38,541	241,034	21,200
Egg yolks..........		6,869		25,795		22,781		37,036		10,992
Feathers and downs, crude..........		2,032,566		2,476,659		2,742,018		2,036,791		2,970,260
Fibers, animal:										
Silk—										
Cocoons..........pounds..	4,118	1,695	259	158	29,759	10,697	28,546	7,875	33,592	11,452
Raw, or as reeled from the cocoon..........pounds..	12,620,682	41,714,331	13,637,206	49,002,597	12,630,883	44,461,564	17,812,133	59,542,892	14,505,324	52,855,611
Waste..........do....	1,610,026	919,325	1,633,394	1,008,295	4,062,067	1,628,239	4,516,628	1,489,286	2,813,105	1,213,441
Total silk..........do....	14,234,826	42,635,351	15,270,859	50,011,050	16,722,709	46,100,500	22,357,307	61,040,053	17,352,021	54,080,504
Wool, and hair of the camel, goat, alpaca, and like animals—										
Class 1, clothing..........pounds..	66,131,670	7,927,919	42,202,121	7,488,394	45,575,993	8,573,494	109,888,258	24,762,682	86,810,307	20,936,934
Class 2, combing..........do....	6,091,024	1,071,866	15,233,113	2,833,435	12,934,143	2,819,822	26,551,624	6,521,171	15,204,254	4,214,024
Class 3, carpet..........do....	94,354,272	8,712,003	119,702,562	11,831,132	115,232,698	13,420,275	112,695,864	14,941,705	99,674,107	13,917,414
Total wool..........do....	166,576,966	17,711,788	177,137,796	22,152,961	173,742,834	24,813,591	249,135,746	46,225,558	201,688,668	39,068,372
Total animal fibers....do....	180,811,792	60,347,139	192,408,655	72,164,011	190,465,543	70,914,091	271,493,053	107,265,611	219,040,689	93,148,876
Glue..........pounds..	4,787,762	477,036	5,560,616	602,077	5,798,330	598,546	7,439,735	701,847	6,558,168	632,700
Honey..........gallons..	167,301	56,383	287,696	115,400	206,292	69,053	198,617	76,719	138,221	50,651
Packing-house products:										
Bladders, other than fish..........				34,019		19,578		15,837		23,915
Blood, dried..........						23,671		11,064		24,277
Bones, hoofs, and horns..........		692,634		619,239		536,366		926,505		1,013,351
Bristles—										
Crude, unsorted......pounds..	40,537	28,446	34,239	13,069	11,241	10,976	8,122	4,054	13,435	9,389
Sorted, bunched, or prepared, pounds..........	1,972,572	2,018,885	3,009,806	2,641,535	2,576,615	2,356,325	2,461,464	2,366,444	2,728,114	2,686,357
Total..........pounds..	2,013,109	2,047,331	3,044,045	2,654,604	2,587,856	2,367,301	2,469,586	2,370,498	2,741,549	2,695,746
Grease..........		981,494		876,246		1,157,923		1,170,514		1,295,855
Gut..........		15,826		101,827		60,351		62,630		85,587
Hair..........		1,980,219		2,702,734		2,639,586		3,328,471		3,704,987
Hide cuttings and other glue stock..		696,439		834,421		854,483		1,120,070		1,160,683
Hides and skins, other than furs:										
Cattle hides..........pounds..	148,627,907	17,474,039	131,640,325	16,159,902	85,370,168	10,989,035	113,177,357	14,949,628	156,155,300	21,862,060
Goatskins..........do....	88,038,516	25,478,179	85,114,070	24,928,729	86,338,547	23,971,731	97,803,571	26,945,721	111,079,391	31,773,909
Other..........do....	89,457,680	15,054,400	102,340,303	16,942,982	103,024,752	17,045,304	126,893,934	22,868,797	158,045,419	30,246,198
Total..........do....	326,124,103	58,006,618	319,094,698	58,031,613	274,733,467	52,006,070	337,874,862	64,764,146	425,280,110	83,882,167

a Forest products come within the scope of the Department of Agriculture and are therefore included in alphabetical order in these tables.

Agricultural imports of the United States during the five years ending June 30, 1906—Continued.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER—continued.										
Packing-house products—Continued.										
Meat—										
Sausages, bologna		$109,791		$111,647		$121,143		$147,119	744,634	$149,593
Other, including meat extracts		464,745		719,250		814,341		674,441		675,568
Total meat		574,536		830,897		935,484		821,560		825,161
Oils ... gallons	161,306	29,060	261,421	50,641	171,544	34,830	175,620	27,559	160,854	23,914
Rennets		93,758		76,785		94,439		99,481		93,288
Sausage casings		754,588		963,495		885,645		836,323		874,293
Stearin ... pounds	7,634,293	492,287	10,481,807	1,097,450	1,492,407	110,606	2,800,540	191,960	1,700,177	134,196
Other		380,403		706,802		50,619		52,223		68,843
Total packing-house products		66,744,893		69,580,773		61,756,952		75,798,841		95,906,263
Total animal matter		137,133,199		152,957,236		142,828,138		192,957,587		201,249,467
VEGETABLE MATTER.										
Argols, or wine lees ... pounds	29,276,148	2,263,588	29,966,557	2,734,027	24,571,730	2,550,223	26,281,931	2,291,951	28,140,835	2,358,061
Breadstuffs. (*See* Grain and grain products.)										
Broom corn ... tons	5	553	3	288	6	392	3	918	1	777
Cider ... gallons	8,006	7,159	4,871	4,751	5,609	5,941	8,651	8,931	13,644	1,013
Cocoa and chocolate:										
Cocoa—										
Crude, and leaves and shells of ... pounds	51,379,396	6,656,504	63,351,294	7,820,087	72,277,600	8,873,709	73,815,895	8,577,649	80,117,402	8,697,515
Prepared, or manufactured, pounds	973,970	295,921	1,004,766	292,522	1,009,082	300,409	874,878	259,037	1,055,031	299,141
Total cocoa ... pounds	52,353,366	6,952,425	64,356,060	8,112,609	73,286,682	9,174,118	74,690,773	8,836,686	81,172,433	8,996,656
Chocolate ... do	525,221	101,536	690,824	144,832	1,784,064	426,486	2,692,251	647,377	2,954,594	702,717
Total cocoa and chocolate, pounds	52,878,587	7,053,961	65,046,884	8,257,441	75,070,746	9,600,604	77,383,024	9,484,063	84,127,027	9,699,373
Coffee ... pounds	1,091,004,252	70,982,155	915,086,380	59,200,749	995,043,284	69,551,799	1,047,792,984	84,654,062	851,668,933	73,256,134

Coffee substitutes:										
Chicory root—										
Raw, unground..........do....	238,272	4,687	1,411,202	27,967	4,138,248	68,312	3,340,913	59,589	3,401,065	58,502
Roasted, ground, or otherwise prepared............pounds..	298,671	10,451	442,311	17,493	534,267	20,175	596,095	22,395	546,809	20,560
Total chicory root...do....	536,943	15,138	1,853,513	45,460	4,672,515	88,487	3,937,008	81,984	3,947,874	79,062
Other......................do....	400,527	20,499	450,643	23,613	462,378	26,483	244,327	15,407	439,227	28,705
Total coffee substitutes....do....	937,470	35,637	2,304,156	69,073	5,134,893	114,970	4,181,335	97,391	4,387,101	107,767
Curry and curry powder...............	....	9,010	....	9,112	....	9,955	....	8,327	....	10,424
Fibers, vegetable:										
Cotton....................pounds..	98,715,680	11,712,170	74,874,426	10,892,591	48,840,590	8,541,510	60,508,548	9,414,750	70,963,633	10,879,592
Flax.......................tons..	7,772	2,094,915	8,155	2,028,012	10,123	2,541,874	8,089	2,260,421	8,729	2,327,300
Hemp......................do....	6,054	1,013,911	4,919	821,261	5,871	869,260	3,987	638,325	5,317	906,808
Istle, or Tampico fiber.......do....	7,819	495,254	14,670	1,086,682	13,622	1,199,014	15,607	1,405,184	13,914	1,283,311
Jute and jute butts..........do....	128,963	4,447,987	79,703	3,358,825	96,735	4,104,870	98,215	4,500,023	103,945	6,449,684
Manila hemp................do....	56,453	10,555,272	61,648	11,885,510	65,666	11,423,395	61,562	12,065,270	58,738	11,036,667
Sisal grass..................do....	89,583	11,961,213	87,025	13,289,444	109,214	15,935,555	100,301	15,256,859	98,037	15,282,208
Other......................do....	9,083	977,410	16,075	1,992,779	14,428	1,740,317	17,149	1,991,989	18,603	2,074,312
Total..........................	....	43,258,132	....	45,355,104	....	46,355,795	....	47,532,821	....	50,239,882
Flowers, natural......................	....	30,382	....	31,577	....	42,612	....	29,080	....	27,275
Forest products:										
Charcoal..........................	....	....	....	....	231,302	14,844	5,643	478	774,501	42,856
Cinchona bark............pounds..	3,723,303	649,764	3,978,850	549,753	3,605,131	501,375	4,251,869	570,725	4,076,553	383,726
Cork wood or cork bark............	....	1,816,107	....	1,737,366	....	1,484,405	....	1,729,143	....	1,837,134
Dyewoods, and extracts of—										
Dyewoods—										
Logwood.............tons..	52,657	774,380	51,008	748,550	48,491	663,572	35,514	444,824	37,313	496,551
Other....................	....	171,120	....	401,849	....	588,934	....	77,751	....	109,515
Total dyewoods..........	....	945,500	....	1,150,399	....	1,252,506	....	522,575	....	606,066
Extracts and decoctions of, pounds......................	2,991,631	213,404	3,723,133	267,371	3,145,770	269,777	3,436,642	299,036	3,390,316	290,179
Total dyewoods and extracts of.................	....	1,158,904	....	1,417,770	....	1,522,283	....	821,611	....	896,245

Agricultural imports of the United States during the five years ending June 30, 1906—Continued.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Forest products—Continued.										
Gums, not elsewhere specified—										
Arabic .... pounds.	4,269,251	$341,714	3,905,053	$265,386	2,890,051	$186,623	3,651,544	$190,132	4,055,233	$232,715
Camphor, crude .... do...	1,831,058	576,405	2,472,440	764,403	2,819,673	874,665	1,904,002	638,744	1,668,744	608,440
Chicle .... do...	4,574,605	936,065	4,282,247	954,389	5,084,580	1,308,540	5,060,166	1,357,458	5,641,508	1,495,366
Copal, cowrie, and dammar, pounds	20,523,109	2,261,206	27,653,928	2,988,754	20,565,507	2,127,228	25,687,762	2,493,438	20,448,703	1,914,663
Gambier, or terra japonica, pounds	28,453,802	1,162,233	42,537,348	2,034,511	27,857,055	1,251,782	32,192,721	1,112,660	31,278,485	1,118,910
Shellac .... pounds.	9,064,789	1,605,068	11,590,725	2,713,687	10,933,413	3,505,229	10,700,817	3,743,180	15,780,090	5,107,542
Other	....	861,492	....	923,517	....	917,815	....	1,094,869	....	1,423,088
Total	....	7,744,183	....	10,594,647	....	10,171,882	....	10,630,481	....	11,900,724
Hemlock bark .... cords.	24,971	103,930	17,040	75,283	14,111	63,460	13,511	64,181	7,467	35,860
India rubber, gutta-percha, etc.										
Balata .... pounds	([a])	([a])	([a])	([a])	([a])	([a])	([a])	([a])	374,220	152,689
Gutta-joolatong, or East Indian gum .... pounds.	16,850,821	501,418	13,984,817	345,431	14,887,416	430,231	19,104,911	641,319	21,390,116	733,074
Gutta-percha .... do...	525,767	252,329	316,290	222,400	424,617	174,953	665,217	210,188	500,770	188,161
India rubber .... do...	50,413,481	24,899,230	55,010,571	30,436,710	59,015,551	40,444,250	67,234,256	49,878,366	57,844,345	45,114,450
Total .... do...	67,790,069	25,652,977	69,311,678	31,004,541	74,327,584	41,049,434	87,004,384	50,729,873	80,109,451	46,188,374
Ivory, vegetable .... do...	14,699,215	165,489	17,194,434	192,093	15,740,792	229,944	19,688,913	410,883	21,076,508	516,607
Naval stores—										
Tar and pitch (of wood), barrels	1,660	8,796	1,242	6,004	1,063	6,643	571	3,206	1,363	6,504
Turpentine, spirits of, gallons.	8,457	2,814	16,705	6,020	19,751	6,224	43,063	13,546	158,730	59,273
Total	....	11,610	....	12,024	....	12,867	....	16,752	....	65,777
Palm leaf, natural	....	10,905	....	5,339	....	5,610	....	9,434	....	8,114
Sumac, ground .... pounds.	9,182,917	145,776	12,858,547	187,186	18,604,641	276,891	15,583,331	225,036	15,131,539	237,309
Tanning materials, n. e. s.	....	47,500	....	56,401	....	194,201	....	923,949	....	1,419,962
Wood, not elsewhere specified—										
Cabinet woods, unsawed—										
Mahogany .... M feet..	44,795	2,361,483	48,387	2,783,679	50,370	2,690,382	31,844	1,977,894	36,619	2,470,072
Other	....	999,792	....	1,251,621	....	1,434,229	....	1,077,723	....	1,334,748
Total cabinet woods	....	3,361,275	....	4,035,300	....	4,124,611	....	3,055,617	....	3,804,820

Timber—										
Round, including logs, M feet	106,171	907,168	73,836	637,881	66,033	552,504	97,306	722,693	100,592	773,260
Hewn, squared, or sided, cubic feet	129,183	18,027	207,554	41,131	139,180	33,357	181,742	28,912	256,180	46,770
Total timber		925,195		679,012		585,861		751,605		820,030
Lumber—										
Boards, deals, planks, and other sawed lumber, M feet	665,603	9,271,090	720,937	10,673,317	589,232	8,878,474	710,538	10,906,661	949,717	14,813,733
Shingles M	707,614	1,362,821	724,131	1,494,906	770,373	1,602,999	758,725	1,581,421	900,856	1,852,612
Other		1,380,973		1,753,532		1,545,384		1,649,314		2,700,505
Total lumber		12,014,884		13,921,755		12,026,857		14,137,396		19,366,850
All other		3,319,458		3,621,782		3,752,103		4,102,436		4,353,034
Total wood, n. e. s		19,620,812		22,257,849		20,489,432		22,047,054		28,344,734
Wood pulp tons	67,410	2,059,092	116,881	3,387,770	144,796	3,602,668	167,504	4,500,955	157,224	4,584,942
Total forest products		59,187,049		71,478,022		79,619,296		92,680,555		96,462,364
Fruit juices, n. e. s.:										
Prune juice, or prune wine gallons	42,817	32,925	53,135	40,435	70,521	38,227	52,765	37,118	50,237	34,900
Other, including cherry juice do	29,108	15,114	32,810	16,709	62,988	27,731	23,574	14,130	40,893	24,661
Total do	71,925	48,039	85,945	57,144	133,509	65,958	76,339	51,248	91,130	59,561
Fruits:										
Fresh or dried—										
Bananas		7,307,437		8,541,156		7,709,976		9,897,821		10,330,302
Currants pounds	36,238,976	1,238,750	33,878,209	743,644	38,347,649	997,430	31,742,919	764,289	37,078,311	1,119,146
Dates do	20,013,681	344,833	21,681,159	486,151	21,058,164	463,459	19,257,250	360,483	22,435,672	479,142
Figs do	11,087,131	487,733	16,482,142	775,917	13,178,061	660,360	13,364,107	617,027	17,562,358	722,967
Lemons do	164,075,309	3,320,359	152,004,213	3,079,221	171,923,221	3,659,598	139,084,321	2,905,082	138,717,252	2,933,990
Oranges do	52,742,476	784,640	56,872,070	818,780	35,893,260	525,468	28,880,575	374,088	31,134,341	456,726
Plums and prunes do	522,478	44,077	633,819	63,218	494,105	46,976	671,604	63,617	497,494	53,348
Raisins do	6,683,545	399,973	6,715,675	476,844	6,867,617	355,542	4,041,689	273,031	12,414,855	524,590
Other		2,053,588		2,353,864		2,749,670		2,924,187		2,484,345
Total fresh or dried		15,981,396		17,338,795		17,168,479		18,179,625		19,104,556
Prepared or preserved		1,454,788		1,521,443		1,796,209		1,599,488		2,437,766
Total fruits		17,436,184		18,860,238		18,964,688		19,779,113		21,542,322
Ginger, preserved or pickled pounds	660,494	28,194	569,292	23,810	230,890	13,502	436,051	24,874	365,255	19,516

Agricultural imports of the United States during the five years ending June 30, 1906—Continued.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Grain and grain products:										
Grain—										
Barley .... bushels..	57,406	$33,221	56,462	$30,201	90,708	$45,245	81,020	$39,546	18,049	$9,803
Corn .... do ..	18,278	13,418	40,919	29,966	16,633	10,837	15,443	10,623	10,127	8,458
Oats .... do..	25,812	12,085	137,416	45,899	170,882	57,802	38,773	18,626	22,675	10,726
Rye .... do..	88	97	838	430	32,512	20,329	20,551	13,576	5	4
Wheat .... do ..	118,612	78,640	1,077,424	669,419	6,852	7,517	3,102,585	2,769,317	57,995	53,201
Total grain .... do	220,196	137,461	1,313,059	775,915	317,587	141,730	3,258,372	2,851,688	108,851	82,282
Grain products—										
Macaroni, vermicelli, etc. pounds .	(a)	(a)	28,787,821	1,171,887	40,224,202	1,617,634	53,441,080	2,083,833	77,926,029	2,941,204
Malt .... bushels	3,019	2,929	2,468	3,020	3,465	3,250	3,298	3,580	2,458	2,711
Meal and flour—										
Oatmeal .... pounds .	236,981	13,628	227,681	13,685	235,819	14,201	304,668	16,361	312,306	16,625
Wheat flour .... barrels	420	2,610	601	4,489	46,851	164,100	40,801	176,513	45,314	177,239
Total meal and flour	....	16,238	....	18,174	....	178,301	....	192,874	357,620	193,864
Other	....	1,380,658	....	438,963	....	613,916	....	667,427	....	465,838
Total grain products...	....	1,399,825	....	1,632,053	....	2,413,101	....	2,947,714	....	3,603,617
Total grain and grain products	....	1,537,286	....	2,407,968	....	2,554,831	....	5,799,402	....	3,685,899
Hay .... tons..	48,415	381,417	293,112	2,238,109	114,388	914,842	46,211	359,515	68,540	502,051
Hops .... pounds..	2,805,293	833,702	6,012,510	1,808,491	2,758,163	1,374,327	4,339,379	1,980,804	10,113,989	2,326,982
Indigo .... do...	3,057,673	1,035,980	4,532,458	1,202,451	5,046,614	1,282,497	1,830,930	873,781	7,492,853	1,044,148
Licorice root .... do....	109,077,323	1,926,903	88,580,611	1,545,167	89,463,182	1,472,323	108,443,893	1,780,109	102,151,969	1,661,454
Liquors, alcoholic:										
Distilled spirits—										
Of domestic manufacture, returned .... proof gallons..	805,212	749,687	819,591	846,404	471,596	539,362	316,469	326,885	177,499	211,197
Brandy .... do....	316,222	911,419	348,878	1,000,997	390,988	1,104,410	403,386	1,130,129	470,433	1,286,220

Other....................do....	1,909,887	2,784,048	2,061,057	2,987,179	2,238,842	3,313,735	2,366,466	3,539,044	2,639,680	4,027,368
Total distilled spirits, proof gallons....................	3,031,321	4,445,154	3,229,526	4,834,580	3,101,426	4,957,507	3,086,321	5,005,058	3,287,612	5,524,767
Malt liquors—										
Unbottled............gallons..	2,553,105	718,383	2,966,343	835,694	3,197,955	927,507	3,836,487	1,119,768	4,395,032	1,272,627
Bottled.................do....	1,198,406	1,161,965	1,292,475	1,252,047	1,467,756	1,385,818	1,362,089	1,285,576	1,582,619	4,466,228
Total malt liquors.....do....	3,751,511	1,880,348	4,258,818	2,087,741	4,665,711	2,313,325	5,198,576	2,405,344	5,977,651	2,738,855
Wines—										
Champagne and other sparkling...........dozen quarts..	335,256	4,930,768	407,944	5,861,639	336,245	4,969,635	371,811	5,723,764	415,394	6,127,062
Still wines—										
Unbottled........gallons..	3,300,026	2,143,433	3,753,211	2,292,297	4,007,691	2,387,018	3,973,919	2,352,485	4,482,499	2,567,712
Bottled.....dozen quarts..	397,818	1,846,937	440,869	2,095,360	471,153	2,035,217	488,773	2,165,672	546,688	2,299,194
Total still wines.............	....	3,990,370	....	4,387,657	....	4,422,235	....	4,518,157	....	4,866,906
Total wines.................	....	8,921,138	....	10,249,296	....	9,391,870	....	10,241,921	....	10,993,968
Total alcoholic liquors.......	....	15,246,640	....	17,171,617	....	16,662,702	....	17,652,323	....	19,257,590
Malt, barley. (*See* Grain and grain products.)										
Malt extract, fluid or solid............	....	3,683	....	3,008	....	2,924	....	5,128	....	2,473
Malt liquors. (*See* Liquors, alcoholic.)										
Meal, cottonseed..............pounds..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	661,505	4,991
Nursery stock:										
Plants, trees, shrubs, vines, etc.....	....	1,172,023	....	1,371,588	....	1,493,789	....	1,510,435	....	1,599,052
Subtropical plants, etc., for propagation..........................	....	547	....	1,610	....	2,638	....	1,631	....	18,570
Total nursery stock..........	....	1,172,570	....	1,373,198	....	1,496,427	....	1,512,066	....	1,617,622
Nuts:										
Almonds ....pounds..	9,868,982	1,240,886	8,142,164	1,337,717	9,838,852	1,246,474	11,745,081	1,520,063	15,009,326	1,825,475
Cocoanuts..........................	....	832,383	....	908,242	....	971,852	....	1,086,473	....	1,298,740
Walnuts.................pounds..	(a)	(a)	12,362,567	1,106,033	23,670,761	1,729,378	21,864,104	1,469,463	24,917,028	2,193,653
Other............................	....	1,971,072	....	1,514,406	....	1,523,462	....	2,082,344	....	2,055,557
Total nuts.................	....	4,044,341	....	4,866,398	....	5,471,166	....	6,158,343	....	7,373,425
Oil cake.....................pounds..	2,614,059	20,740	3,827,014	30,286	1,794,873	18,592	1,129,013	12,968	5,454,941	54,144

[a] Not stated.

Agricultural imports of the United States during the five years ending June 30, 1906—Continued.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Oils, vegetable:										
Fixed or expressed—										
Olive, for mechanical purposes, gallons	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	2,447,131	$2,566,994
Olive, salad ....gallons..	1,339,097	$1,573,409	1,494,132	$1,736,648	1,713,590	$1,875,825	1,923,174	$2,108,893	2,538,366	1,105,876
Other		5,046,811		7,750,712		5,952,702		6,010,432		6,015,403
Total fixed or expressed		6,626,220		9,487,360		7,828,527		8,119,325		9,688,273
Volatile, or essential		2,092,371		2,156,331		2,396,748		2,534,723		2,863,005
Total vegetable oils		8,718,591		11,643,691		10,225,275		10,654,048		12,551,278
Olive nuts, ground		(a)		(a)		(a)		(a)		6,899
Opium, crude ....pounds..	534,189	1,216,202	516,570	1,019,909	573,055	1,255,115	594,680	1,162,461	469,387	1,143,683
Rice, rice meal, etc.:										
Rice ....do....	75,674,776	1,596,210	78,317,310	1,732,238	75,323,157	1,869,338	43,408,509	1,097,099	58,468,791	1,465,487
Rice flour, rice meal, and broken rice ....pounds..	81,984,118	1,330,711	91,338,974	1,329,235	78,898,615	1,204,092	63,075,006	913,867	108,079,166	1,616,716
Total ....do....	157,658,894	2,926,921	169,656,284	3,061,473	154,221,772	3,073,430	106,483,515	2,010,966	166,547,957	3,082,203
Sago, tapioca, etc		545,938		618,221		695,922		761,525		830,479
Seeds:										
Flaxseed, or linseed ....bushels..	477,157	724,082	129,089	194,024	213,270	201,224	296,184	318,687	52,240	73,423
Other		2,528,070		2,637,255		3,386,245		3,138,932		5,314,620
Total		3,252,152		2,831,279		3,587,469		3,457,619		5,388,043
Spices:										
Unground—										
Nutmegs ....pounds..	1,841,614	339,685	2,365,624	444,643	1,498,600	288,388	2,394,061	347,721	2,626,005	342,378
Pepper, black or white, pounds	16,046,179	1,752,345	21,832,675	2,296,221	18,615,186	2,069,051	19,413,387	1,969,521	26,535,834	2,733,137
Other ....pounds..	15,134,481	1,146,246	22,464,192	1,590,778	17,745,806	1,469,587	26,115,130	1,731,895	20,037,435	1,429,008
Total unground ....do....	33,022,274	3,238,276	46,662,491	4,331,642	37,859,592	3,827,026	47,922,578	4,049,137	49,199,274	4,504,523

Ground ... do	4,460,841	446,966	4,538,688	483,483	5,414,804	538,982	5,106,179	534,219	7,047,685	683,593
Total spices ... do	37,483,115	3,685,242	51,201,179	4,815,125	43,274,396	4,366,008	53,028,757	4,583,356	56,246,959	5,188,116
Spirits distilled. (*See* Liquors, alcoholic.)										
Starch ... pounds	11,714,931	235,645	10,540,905	205,949	7,430,383	191,450	6,140,753	180,465	5,422,267	156,176
Straw ... tons	2,986	11,723	3,303	12,832	10,838	81,794	2,825	12,700	4,317	16,539
Sugar and molasses:										
Molasses ... gallons	14,391,215	1,037,696	17,240,399	1,124,710	18,828,530	1,018,198	19,477,885	1,137,844	16,021,076	690,718
Sugar—										
Raw—										
Beet ... pounds	255,030,219	4,202,044	87,130,805	1,223,023	2,414,454	50,525	223,944,976	4,797,278	48,548,919	1,032,040
Cane ... do	2,685,792,937	48,684,775	4,075,635,121	69,740,051	3,681,904,214	71,359,114	3,434,186,471	91,943,398	3,921,605,729	84,066,863
Total raw ... do	2,940,823,156	52,886,819	4,162,765,926	70,963,074	3,684,318,668	71,409,639	3,658,131,447	96,740,676	3,970,154,648	85,098,903
Refined ... do	91,092,719	2,174,278	53,342,180	1,125,899	16,304,945	506,114	22,801,551	904,773	9,176,782	361,185
Total sugar ... do	3,031,915,875	55,061,097	4,216,108,106	72,088,973	3,700,623,613	71,915,753	3,680,932,998	97,645,449	3,979,331,430	85,460,088
Total sugar and molasses	...	56,098,793	...	73,213,683	...	72,933,951	...	98,783,293	...	86,150,806
Tea ... pounds	75,579,125	9,390,128	108,574,905	15,659,229	112,905,541	18,229,310	102,706,599	16,230,858	93,621,750	14,580,878
Teasels	...	(a)	...	(a)	...	(a)	...	(a)	...	10,169
Tobacco:										
Wrapper ... pounds	5,729,879	5,084,606	6,314,359	4,669,932	7,387,390	5,641,124	7,109,595	5,270,032	6,732,774	6,475,226
Filler and other leaf ... do	23,698,958	10,127,065	27,702,597	12,564,983	23,775,246	11,298,363	26,178,783	12,768,645	30,622,703	15,972,288
Stems ... do	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	3,770,493	15,954
Total ... do	29,428,837	15,211,671	34,016,956	17,234,915	31,162,636	16,939,487	33,288,378	18,038,677	41,125,970	22,463,468
Vanilla beans ... pounds	361,739	859,399	521,689	1,032,654	550,328	1,424,647	608,116	871,442	852,505	1,321,550
Vegetables:										
Fresh or dried—										
Beans and dried pease, bushels	881,966	1,152,177	1,088,665	1,420,334	978,187	1,223,309	472,572	628,775	458,041	667,214
Onions ... do	796,316	608,673	925,599	699,657	1,171,242	914,413	856,366	643,207	872,566	615,584
Potatoes ... do	7,656,162	3,160,801	358,505	238,445	3,166,581	1,870,004	181,199	168,094	1,948,160	853,063
Other	...	536,581	...	497,666	...	730,761	...	646,736	...	815,068
Total fresh or dried	...	5,458,232	...	2,856,102	...	4,788,487	...	2,086,812	...	2,950,929

a Not stated.

Agricultural imports of the United States during the five years ending June 30, 1906—Continued.

Article imported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Vegetables:										
Prepared or preserved— Pickles and sauces		$480,342		$537,356		$646,858		$578,489		$706,050
Other		1,101,261		1,187,897		1,573,257		1,317,971		1,435,953
Total prepared or preserved		1,581,603		1,725,253		2,220,115		1,896,460		2,142,003
Total vegetables		7,039,835		4,581,355		7,008,602		3,983,272		5,092,932
Vinegar ....gallons	168,195	45,754	152,524	42,656	181,294	46,856	191,768	46,434	198,591	49,319
Wafers, unmedicated		17,108		19,111		20,327		19,293		26,353
Wines. (*See* Liquors, alcoholic.)										
Total vegetable matter, including forest products		335,798,407		374,720,111		398,226,009		453,574,182		449,388,139
Total vegetable matter, excluding forest products		276,611,358		303,242,089		318,606,713		360,893,627		352,925,775
Total agricultural imports, including forest products		472,931,606		527,677,347		541,054,147		646,531,769		650,637,606
Total agricultural imports, excluding forest products		413,744,557		456,199,325		461,434,851		553,851,214		554,175,242

Agricultural exports (domestic) of the United States during the five years ending June 30, 1906.

Article exported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
ANIMAL MATTER.										
Animals, live:										
Cattle..........number..	392,884	$29,902,212	402,178	$29,848,936	593,409	$42,256,291	567,806	$40,598,048	584,239	$42,081,170
Hogs..........do....	8,368	88,330	4,031	40,923	6,345	53,780	44,496	416,692	59,170	630,998
Horses..........do....	103,020	10,048,046	34,007	3,152,159	42,001	3,189,100	34,822	3,175,259	40,087	4,365,981
Mules..........do....	27,586	2,692,298	4,294	521,725	3,658	412,971	5,826	645,464	7,167	989,639
Sheep..........do....	358,720	1,940,060	176,961	1,067,860	301,313	1,954,604	268,365	1,687,321	142,690	804,090
Other, including fowls..........	....	200,738	....	149,590	....	111,129	....	205,497	....	267,690
Total..........	....	44,871,684	....	34,781,193	....	47,977,875	....	46,728,281	....	49,139,568
Beeswax..........pounds..	125,283	36,541	70,811	21,337	55,631	16,545	85,406	24,966	101,726	29,894
Dairy products:										
Butter..........do....	16,002,169	2,885,609	8,896,166	1,604,327	10,717,824	1,768,184	10,071,487	1,648,281	27,360,537	4,922,913
Cheese..........do....	27,203,184	2,745,597	18,987,178	2,250,229	23,335,172	2,452,239	10,134,424	1,084,044	16,562,451	1,940,620
Milk..........	....	1,473,564	....	921,026	....	1,367,794	....	2,156,616	....	1,889,690
Total..........	....	7,104,770	....	4,775,582	....	5,588,217	....	4,888,941	....	8,753,223
Eggs..........dozens..	2,717,990	528,679	1,517,189	325,571	1,776,632	396,408	2,475,884	543,386	4,952,063	1,038,649
Egg yolks..........	....	14,700	....	48,108	....	28,294	....	917	....	54,851
Feathers..........	....	239,756	....	141,257	....	157,035	....	239,256	....	263,377
Fibers, animal:										
Silk waste..........pounds..	81,477	9,759	149,400	19,968	227,139	30,814	72,451	9,806	71,368	13,781
Wool..........do....	123,278	13,369	518,919	71,818	319,750	37,171	123,951	15,068	192,481	29,095
Total..........do....	204,755	23,128	668,319	91,786	546,889	67,985	196,402	24,874	263,849	42,876
Glue..........do....	2,907,632	284,413	2,569,164	253,768	2,656,057	258,511	2,824,202	279,534	3,157,837	298,796
Honey..........	....	106,112	....	64,220	....	69,317	....	63,367	....	111,945
Packing-house products:										
Bones, hoofs, horns, and horn tips, strips, and waste..........	....	163,180	....	193,817	....	208,523	....	181,203	....	212,516
Bristles..........	....	17	....	515	....	1,808	....	1,497	....	329
Grease, grease scraps, and other soap stock..........	....	2,610,925	....	2,926,565	....	3,311,777	....	3,710,907	....	4,138,333
Hair..........	....	633,337	....	616,133	....	724,514	....	778,471	....	854,038
Hides and skins, other than furs, pounds..........	9,372,747	906,504	12,859,549	1,224,409	32,727,643	3,246,887	10,268,722	1,051,641	10,752,827	1,223,255

Agricultural exports (domestic) of the United States during the five years ending June 30, 1906—Continued.

Article exported.	1902. Quantity.	1902. Value.	1903. Quantity.	1903. Value.	1904. Quantity.	1904. Value.	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.
ANIMAL MATTER—continued.										
Packing-house products—Continued.										
Lard .... pounds	556,840,222	$52,375,864	490,755,821	$50,854,504	561,302,043	$46,347,520	610,238,899	$47,243,181	741,516,886	$60,132,091
Lard compounds .... do	36,201,744	2,687,653	46,130,004	3,607,542	53,603,545	3,581,813	61,215,187	3,613,235	67,621,310	4,154,183
Meat—										
Beef—										
Fresh .... do	301,824,473	29,045,056	254,795,963	25,013,323	290,579,671	26,841,586	236,486,568	22,138,365	268,054,227	24,310,038
Cured—										
Salted or pickled do	48,632,727	3,031,027	52,801,220	3,814,671	57,584,710	3,260,475	55,934,705	3,095,304	81,088,098	4,697,742
Other .... do	818,382	72,836	1,126,032	102,184	269,112	20,542	136,476	14,057	199,483	22,063
Total cured .... do	49,451,109	3,103,863	53,927,252	3,916,855	57,853,822	3,281,017	56,071,181	3,109,361	81,287,581	4,719,805
Canned .... do	66,645,838	6,646,130	76,307,114	7,916,928	57,468,338	5,882,888	66,688,568	6,588,958	64,523,359	6,430,446
Total beef .... do	417,921,420	38,795,049	385,030,329	36,847,106	414,901,831	36,005,491	359,246,317	31,836,684	413,865,167	35,460,289
Canned meat, n. e. s.	....	1,801,385	....	1,831,940	....	2,254,235		1,974,693	....	1,593,407
Mutton .... pounds	430,351	37,067	6,144,020	532,476	465,255	40,618	640,837	52,503	516,345	51,163
Pork—										
Fresh .... do	44,171,674	3,652,464	20,966,113	2,035,491	18,633,820	1,669,818	14,946,284	1,291,794	13,444,438	1,261,412
Cured—										
Bacon .... do	383,150,624	35,449,797	207,336,000	22,178,525	249,665,941	24,440,752	262,246,635	25,428,961	361,210,563	35,845,793
Hams .... do	227,653,232	25,222,744	214,183,365	25,712,633	194,948,864	22,293,867	203,458,724	21,562,204	194,267,949	20,075,511
Salted or pickled do	115,896,275	10,117,562	95,287,374	9,959,762	112,224,861	9,527,388	118,887,189	9,412,034	141,820,720	11,681,634
Total cured .... do	726,700,131	70,790,103	516,806,739	57,850,920	556,839,666	56,268,007	584,592,548	56,403,199	697,299,232	67,602,938
Canned .... do	9,603,882	832,910	13,590,897	1,369,687	9,479,312	963,321	10,254,239	993,394	12,699,800	1,215,857
Total pork .... do	780,475,687	75,275,477	551,363,749	61,256,098	584,952,798	58,901,146	609,793,071	58,688,387	723,443,470	70,080,207
Sausage and sausage meat, pounds	7,137,297	726,437	5,264,648	585,088	5,562,349	602,528	6,061,508	671,241	7,926,786	881,686
Total meat	....	116,635,415	....	101,052,708	....	97,804,018	....	93,223,508	....	108,066,842

Oils—										
Lard oil..............gallons..	460,035	327,794	556,658	306,334	376,826	244,499	260,797	154,409	298,103	180,474
Oleo oil..............pounds..	138,546,088	12,254,969	126,010,339	11,981,888	165,183,830	12,873,558	145,228,245	11,485,145	209,658,075	17,455,976
Other................gallons..	352,201	201,535	221,669	159,505	452,481	273,481	377,777	217,596	338,687	224,991
Total oils..................	....	12,784,298	....	12,447,727	....	13,391,538	....	11,857,150	....	17,861,441
Oleomargarin (imitation butter), pounds..........................	5,721,254	601,521	7,645,652	798,273	6,137,251	605,874	7,863,164	711,038	11,794,174	1,033,256
Sausage casings..................	....	1,795,044	....	1,964,524	....	2,353,167	....	2,640,868	....	2,572,479
Tallow....................pounds..	34,065,758	1,924,577	27,368,924	1,623,852	76,924,174	3,801,302	63,536,992	3,022,173	97,567,156	4,791,025
Other..........................	....	3,624,764	....	2,101,785	....	2,062,813	....	2,267,359	....	2,633,986
Total packing-house products....	....	196,743,099	....	179,412,354	....	177,441,554	....	170,308,231	....	207,673,774
Poultry and game................	....	856,801	....	1,079,056	....	1,009,304	....	897,425	....	1,397,004
Quills..........................	....	6,168	....	3,976	....	23,164	....	1,618	....	150
Silk waste. (*See* Fibers, animal.)										
Wool. (*See* Fibers, animal.)										
Total animal matter............	....	250,815,851	....	220,998,208	....	233,034,209	....	224,000,796	....	268,804,107
VEGETABLE MATTER.										
Breadstuffs. (*See* Grain and grain products.)										
Broom corn......................	....	244,358	....	211,253	....	226,179	....	227,060	....	240,164
Broom root......................	....	1,798	....	....	....	....	....	....	....	....
Cider......................gallons..	121,006	21,869	598,119	84,084	714,476	103,314	394,723	61,204	344,117	53,577
Cocoa, ground or prepared, and chocolate..........................	....	166,245	....	213,476	....	250,084	....	279,819	....	349,107
Coffee:										
Green or raw............pounds..	27,088,368	3,209,946	29,233,837	3,295,968	32,208,497	3,656,943	15,559,235	1,966,107	28,346,323	3,483,238
Roasted or prepared.........do....	443,985	71,152	535,108	89,899	405,893	64,516	550,016	82,451	838,181	117,749
Total....................do....	27,532,353	3,281,098	29,768,945	3,385,867	32,614,390	3,721,459	16,109,251	2,048,558	29,184,504	3,600,987
Cotton:										
Sea Island.............{bales....	31,771	2,486,907	51,688	4,038,370	34,776	3,154,376	42,721	3,365,448	42,271	3,335,022
{pounds..	12,231,680		20,205,080		13,254,404		16,653,124		16,245,924	
Upland.................{bales....	6,841,921	288,164,912	6,886,591	312,142,059	5,974,418	367,656,870	8,295,243	376,599,566	[a] 7,008,085	[a]397,670,899
{pounds..	3,488,547,083		3,522,837,942		3,049,938,356		4,288,195,779		[a]3,617,799,246	
Linters....................pounds..	28,195,873	946,537	26,098,947	884,842	26,663,146	1,238,018	34,473,174	1,433,925	([b])	([b])
Total....................do....	3,528,974,636	291,598,356	3,569,141,969	317,065,271	3,089,855,906	372,049,264	4,339,322,077	381,398,939	3,634,045,170	401,005,921
Flavoring extracts and fruit juices....	....	([c])	....	([c])	....	([c])	....	([c])	....	52,490
Flowers, cut....................	....	4,788	....	5,290	....	5,076	....	4,522	....	3,496

[a] Including linters.

[b] Included in upland.

[c] Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1906—Continued.

Article exported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Forest products:										
Bark, and extracts of, for tanning—										
Bark ..... pounds..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	4,873,237	$75,084
Bark, extracts of	.....	(a)	.....	(a)	.....	(a)	.....	(a)	.....	356,847
Total	.....	$288,012	.....	$239,786	.....	$291,783	.....	$552,909	.....	431,931
Charcoal	.....	4,929	.....	5,118	.....	22,646	.....	23,479	.....	14,727
Moss	.....	(a)	.....	(a)	.....	(a)	.....	(a)	.....	37,201
Naval stores—										
Rosin ..... barrels..	2,535,962	4,202,104	2,396,498	4,817,205	2,585,108	6,621,870	2,310,275	7,069,084	2,438,556	9,899,080
Tar ..... do....	23,236	55,854	18,622	50,802	15,644	44,944	20,291	60,520	16,821	55,362
Turpentine and pitch ..... do....	18,370	44,356	15,972	36,379	13,177	32,253	24,971	74,938	14,232	43,875
Turpentine, spirits of . gallons..	19,177,788	7,431,248	16,378,787	8,014,322	17,202,808	9,446,155	15.894,813	8,902,101	15,981,253	10,077,268
Total	.....	11,733,562	.....	12,918,708	.....	16,145,222	.....	16,106,643	.....	20,075,585
Wood—										
Timber—										
Round	.....	3,343,908	.....	4,506,728	.....	4,473,297	.....	3,040,846	.....	3,866,300
Hewn ..... cubic feet..	5,388,439	1,030,687	3,291,498	787,082	3,788,740	881,557	3,856,623	913,654	3,517,046	877,786
Sawed ..... M feet..	412,750	5,225,003	530,659	7,462,111	558,690	8,472,355	486,411	7,294,168	552,548	10,649,310
Total timber	.....	9,599,598	.....	12,755,921	.....	13,827,209	.....	11,248,668	.....	15,393,396
Lumber—										
Boards, deals, and planks, M feet	942,814	16,978,322	1,065,771	20,965,328	1,426,784	28,603,355	1,283,406	24,483,214	1,344,607	28,695,823
Joists and scantling . M feet..	37.885	472,384	46,894	647,920	60,119	875,062	47,309	704,405	29,119	501,711
Shingles ..... M..	33,224	86,799	38,211	86,245	28,484	82,377	24,345	69,251	26,272	73,635
Shooks—										
Box	.....	700,035	.....	779,777	.....	869,802	.....	825,145	.....	954,268
Other ..... number..	788,241	798,884	566,205	829,248	533,182	795,595	872,192	1,278,972	1,066,253	1,524,549
Total shooks	.....	1,498,919	.....	1,609,025	.....	1,665,397	.....	2,104,117	.....	2,478,817
Staves and heading—										
Heading	.....	123,376	.....	134,383	.....	170,874	.....	148,042	.....	201,219
Staves ..... number..	46,998,512	3,830,432	55,879,010	4,740,680	47,420,095	4,032,344	48,286,285	3,613,635	57,586,378	4,699,877

Total staves and heading	....	3,953,808	....	4,875,063	....	4,203,218	....	3,761,677	....	4,901,096
Other	....	3,572,328	....	3,732,782	....	3,190,687	....	3,068,115	....	3,317,164
Total lumber	....	26,562,560	....	31,916,363	....	38,620,096	....	34,190,679	....	39,968,246
Total wood	....	36,162,158	....	44,672,284	....	52,447,305	....	45,439,347	....	55,361,642
Wood alcohol [b] ..... proof gallons	626,925	338,619	833,629	452,892	1,194,466	585,359	1,097,451	603,385	780,222	466,467
Wood pulp ..... pounds	38,348,632	740,103	22,464,472	445,228	30,230,820	593,474	23,703,906	473,585	29,482,434	587,878
Total forest products	....	48,928,764	....	58,281,124	....	70,085,789	....	63,199,348	....	76,975,431
Fruits:										
Fresh or dried—										
Apples, fresh ..... barrels	459,719	1,628,886	1,656,129	4,381,801	2,018,262	5,446,473	1,499,942	3,859,375	1,208,989	3,751,375
Apples, dried ..... pounds	15,664,468	1,190,593	39,646,297	2,378,635	48,301,665	2,791,421	39,272,890	2,208,414	27,852,831	2,044,820
Apricots, dried ..... do	1,928,367	178,143	9,190,081	713,887	7,205,686	608,511	6,854,154	606,777	13,760,281	1,325,422
Oranges	....	420,835	....	465,397	....	739,593	....	(b)	....	1,110,993
Peaches, dried ..... pounds	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	1,181,649	110,407
Pears, fresh	....	(b)	....	(b)	....	(b)	....	929,151	....	631,972
Prunes ..... pounds	23,358,849	1,404,422	66,385,215	3,512,507	73,146,214	3,410,497	54,993,849	2,455,056	24,869,744	1,410,636
Raisins ..... do	2,323,274	149,216	4,280,028	284,530	4,020,418	281,402	7,054,824	372,087	4,528,502	305,768
Other	....	2,153,050	....	4,215,034	....	4,317,910	....	2,253,638	....	1,727,943
Total fresh or dried	....	7,125,145	....	15,951,791	....	17,595,807	....	12,684,498	....	12,419,336
Preserved—										
Canned	....	1,195,635	....	1,739,571	....	2,637,002	....	2,541,025	....	2,348,064
Other	....	94,323	....	66,757	....	115,490	....	71,868	....	89,872
Total preserved	....	1,289,958	....	1,806,328	....	2,752,492	....	2,612,893	....	2,437,936
Total fruits	....	8,415,103	....	17,758,119	....	20,348,299	....	15,297,391	....	14,857,272
Ginseng ..... pounds	154,063	856,515	151,985	796,008	131,882	851,820	146,576	1,069,849	160,949	1,175,844
Glucose and grape sugar ..... do	130,419,611	2,319,286	126,230,981	2,460,022	152,768,716	2,949,545	175,250,580	3,206,794	189,656,011	3,489,192
Grain and grain products:										
Grain—										
Barley ..... bushels	8,714,268	3,995,303	8,429,141	4,662,544	10,881,627	6,292,914	10,661,655	5,585,544	17,729,360	8,653,231
Buckwheat ..... do	719,615	449,917	117,953	75,713	31,006	19,827	316,399	209,941	696,513	449,129
Corn (maize) ..... do	26,636,552	16,185,673	74,833,237	40,540,637	55,858,965	30,071,334	88,807,223	47,446,921	117,718,657	62,061,856
Oats ..... do	9,971,139	4,153,238	4,613,809	1,850,728	1,153,714	475,362	5,479,308	2,085,992	46,324,935	16,234,918
Rye ..... do	2,697,863	1,581,491	5,422,731	3,143,910	765,108	440,980	1,423	1,191	1,355,528	905,350
Wheat ..... do	154,856,102	112,875,222	114,181,420	87,795,104	44,230,169	35,850,318	4,394,402	3,905,579	34,973,291	28,757,517
Total grain ..... do	203,595,539	139,240,844	207,508,291	138,068,636	112,920,589	73,150,735	109,660,410	59,235,168	218,798,284	117,062,001

[a] Not stated.
[b] Classed as agricultural for the first time in 1904; the statistics for earlier years are not included in the total domestic exports of forest products, 1902-1903.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1906—Continued.

Article exported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Grain and grain products—Continued.										
Grain products—										
Bran, middlings, and mill feed, tons	48,980	$962,595	49,513	$945,053	19,193	$366,213	36,293	$722,582	99,418	$2,052,285
Breadstuff preparations.do	....	2,809,154	....	3,256,945	....	2,807,704	....	2,710,699	....	2,208,585
Distillers and brewers, grains and malt sprouts......tons	66,846	1,157,636	73,104	1,320,065	56,038	1,062,336	75,549	1,485,671	102,683	1,937,315
Malt......bushels	401,375	266,894	347,147	252,801	438,580	315,676	487,158	342,851	881,523	598,453
Meal and flour—										
Corn meal......barrels	348,034	1,046,643	451,506	1,382,127	590,774	1,691,669	371,565	1,113,295	543,794	1,623,397
Oatmeal......pounds	59,516,512	1,617,298	67,823,935	1,839,106	14,526,477	463,062	52,476,917	1,423,742	37,972,903	948,088
Rye flour......barrels	2,369	8,403	3,757	12,818	3,160	11,302	4,721	19,618	5,383	20,019
Wheat flour......do	17,759,203	65,661,974	19,716,484	73,756,404	16,999,432	68,894,836	8,826,335	40,176,136	13,919,048	59,106,869
Total meal and flour	....	68,334,318	....	76,990,455	....	71,060,869	....	42,732,791	....	61,698,373
All other	....	629,797	....	661,131	....	602,521	....	845,999	....	850,090
Total grain products	....	74,160,394	....	83,426,450	....	76,215,319	....	48,840,593	....	69,345,101
Total grain and grain products	....	213,401,238	....	221,495,086	....	149,366,054	....	108,075,761	....	186,407,102
Grasses, dried	....	18,001	....	15,294	....	8,762	....	11,138	....	9,805
Hay......tons	153,431	2,580,622	50,974	828,483	60,730	1,052,705	66,557	1,089,505	70,172	1,116,307
Hops......pounds	10,715,151	1,550,657	7,794,705	1,909,951	10,985,988	2,110,180	14,858,612	4,480,666	13,026,904	3,125,843
Lard compounds. (*See* Meat and meat products.)										
Liquors, alcoholic:										
Distilled spirits—										
Alcohol, including cologne spirits......proof gallons	367,538	220,453	120,697	23,510	587,549	112,299	1,081,871	223,664	504,665	103,833
Brandy......do	24,077	30,174	18,117	19,213	70,193	44,111	21,171	18,217	5,145	8,553
Rum......do	1,095,401	1,425,920	1,096,719	1,458,393	757,227	904,959	911,371	1,175,837	877,922	701,423
Whisky—										
Bourbon......do	611,518	638,061	169,396	203,137	231,540	254,693	212,001	246,115	183,621	245,264
Rye......do	155,046	275,717	104,236	223,480	127,535	217,551	106,893	207,606	109,522	207,783
Total whisky....do	766,564	913,778	273,632	426,617	359,075	472,244	318,894	453,721	293,143	453,047

Other....do....	76,384	82,950	48,014	62,358	47,402	67,854	83,771	97,328	40,089	81,870
Total distilled spirits....do....	2,329,964	2,673,275	1,557,179	1,990,091	1,821,446	1,691,467	2,417,078	1,968,767	1,544,465	1,348,726
Malt liquors—										
Unbottled....gallons..	417,025	90,769	400,072	95,758	382,346	84,687	354,097	80,436	256,575	57,192
Bottled....dozen quarts..	822,899	1,199,293	759,027	1,082,982	540,301	769,432	626,400	932,372	727,731	1,059,584
Total malt liquors....	...	1,290,062	...	1,178,740	...	854,119	...	1,012,808	...	1,116,776
Wines—										
Unbottled....gallons..	929,900	407,345	678,150	290,552	896,643	403,557	839,386	355,215	789,526	326,335
Bottled....dozen quarts..	10,952	42,980	5,232	24,624	6,066	33,136	5,800	28,242	5,596	25,215
Total wines....	...	450,325	...	315,176	...	436,693	...	383,457	...	351,550
Total alcoholic liquors....	...	4,413,662	...	3,484,007	...	2,982,279	...	3,365,032	...	2,817,052
Malt. (*See* Grain and grain products.)										
Malt liquors. (*See* Liquors alcoholic.)										
Malt sprouts. (*See* Grain and grain products.)										
Nursery stock....	...	132,027	...	158,959	...	287,880	...	219,223	...	242,056
Nuts:										
Peanuts....pounds..	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	7,180,163	275,927
Other....	...	(a)	...	(a)	...	(a)	...	(a)	...	140,959
Total nuts....	...	304,241	...	299,558	...	330,366	...	309,195	...	416,886
Oil cake and oil-cake meal:										
Corn....pounds..	14,740,498	164,056	8,093,222	95,568	14,014,885	169,921	24,171,127	278,526	48,420,042	605,346
Cotton-seed....do....	1,050,466,246	12,271,009	1,100,392,988	12,732,497	820,349,073	9,134,088	1,251,907,996	13,897,178	1,110,834,678	13,073,100
Flaxseed, or linseed....do....	582,886,875	7,508,133	570,908,149	7,011,214	668,868,722	7,765,169	618,498,525	7,600,907	758,916,364	10,313,118
Total....do....	1,648,093,619	19,943,198	1,679,394,359	19,839,279	1,503,232,680	17,069,178	1,894,577,648	21,776,611	1,918,171,984	23,991,564
Oils, vegetable:										
Fixed or expressed—										
Corn....gallons..	4,266,398	1,769,370	3,788,035	1,467,493	3,222,875	998,613	3,108,917	890,937	3,833,251	1,172,206
Cotton-seed....do....	33,042,848	12,992,393	35,642,994	14,211,244	29,013,743	10,717,280	51,535,580	15,125,802	43,793,519	13,673,370
Linseed....do....	102,116	68,617	182,330	98,116	336,419	147,721	282,188	125,354	312,766	150,395
Other....	...	220,372	...	169,796	...	189,451	...	139,219	...	244,267
Total fixed or expressed....	...	15,050,752	...	15,946,649	...	12,053,065	...	16,281,312	...	15,240,238

a Not stated.

Agricultural exports (domestic) of the United States during the five years ending June 30, 1906—Continued.

Article exported.	1902.		1903.		1904.		1905.		1906.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
VEGETABLE MATTER—continued.										
Oils, vegetable—Continued.										
Volatile, or essential—										
Peppermint..........pounds..	36,301	$54,898	13,033	$34,943	42,939	$124,728	36,953	$135,060	74,151	$206,261
Other....................	....	202,983	....	252,770	....	440,588	....	215,860	....	459,532
Total volatile, or essential....	....	257,881	....	287,713	....	565,316	....	350,920	....	665,793
Total vegetable oils..........	....	15,308,633	....	16,234,362	....	12,618,381	....	16,632,232	....	15,906,031
Rice, rice meal, etc.:										
Rice....................pounds..	615,036	29,707	532,092	27,048	2,380,418	88,465	74,866,965	2,254,446	3,969,772	138,853
Rice bran, meal, and polish, pounds........................	28,976,238	228,010	19,218,356	122,589	26,741,345	200,263	38,415,795	266,891	34,172,331	255,265
Total...............pounds..	29,591,274	257,717	19,750,448	149,637	29,121,763	288,728	113,282,760	2,521,337	38,142,103	394,118
Root beer..............dozen quarts..	712	1,014	949	834	456	455	332	358	3,276	3,615
Roots, herbs, and barks, n. e. s........	....	290,692	....	320,122	....	266,809	....	339,083	....	364,411
Seeds:										
Cotton..................pounds..	56,403,344	509,627	51,622,370	532,732	12,850,756	141,174	21,101,129	235,833	23,717,326	268,330
Flaxseed, or linseed......bushels..	3,874,033	6,031,887	4,128,130	5,698,492	758,379	820,668	1,338	1,738	5,988,519	7,495,748
Grass seed—										
Clover...............pounds..	7,256,573	594,733	15,522,527	1,549,687	6,440,618	600,626	10,657,365	1,114,015	2,265,760	267,258
Timothy.................do....	5,966,986	373,046	18,289,917	853,829	12,672,676	480,946	16,141,269	584,618	11,247,080	385,454
Other......................	....	315,556	....	581,773	....	299,649	....	303,989	....	217,995
Total grass seed............	....	1,283,335	....	2,985,289	....	1,381,221	....	2,002,622	....	870,707
All other seeds..................	....	202,975	....	238,770	....	240,262	....	317,554	....	277,877
Total seeds..................	....	8,027,824	....	9,455,283	....	2,583,325	....	2,557,747	....	8,912,662
Spices..................................	....	23,471	....	36,787	....	28,521	....	32,372	....	66,970
Spirits, distilled. (*See* Liquors, alcoholic.)										
Starch......................pounds..	28,183,967	656,705	27,759,509	832,943	57,185,739	1,340,282	61,450,444	1,430,572	66,574,881	1,490,797
Straw.....................................	....	5,092	....	1,747	....	4,607	....	7,342	....	7,381
Sugar, molasses, and sirup:										
Molasses..................gallons..	2,911,509	416,470	3,413,387	492,260	3,819,139	592,288	4,384,863	591,879	10,205,885	977,079
Sirup........................do....	14,865,744	2,048,561	12,265,295	1,714,899	12,901,957	1,846,563	13,337,423	2,076,200	12,335,645	1,975,856

Sugar—										
Raw.................pounds..	359,402	14,089	99,101	3,545	113,977	3,427	25,099	969	276,556	7,797
Refined.................do....	7,213,050	292,715	10,421,055	358,537	15,304,560	528,616	18,322,978	745,639	21,899,290	823,221
Total sugar...........do....	7,572,452	306,804	10,520,156	362,082	15,418,537	532,043	18,348,077	746,608	22,175,846	831,018
Total sugar, molasses, and sirup....................		2,771,835		2,569,241		2,970,894		3,414,687		3,783,971
Teasels.............................		23,161		34,258		23,459		6,929		5,012
Tobacco:										
Leaf.....................pounds..	291,369,700	26,881,641	357,496,342	34,972,033	305,382,128	29,464,732	328,232,009	29,644,547	302,333,075	28,602,452
Stems and trimmings........do....	9,637,665	222,355	10,687,742	278,860	6,589,703	176,080	6,070,082	156,269	9,894,127	205,915
Total....................do....	301,007,365	27,103,996	368,184,084	35,250,893	311,971,831	29,640,812	334,302,091	29,800,816	312,227,202	28,808,367
Vegetables:										
Fresh or dried—										
Beans and pease......bushels..	324,481	636,345	232,841	530,875	248,805	546,479	330,321	730,922	447,474	960,710
Onions.................do....	113,531	117,019	145,509	116,624	144,764	116,104	234,048	209,938	205,102	182,060
Potatoes...............do....	528,484	564,550	843,075	552,533	484,042	436,135	1,163,270	750,210	1,000,326	743,993
Total fresh or dried, bushels.........	966,496	1,317,914	1,221,425	1,200,032	877,611	1,098,718	1,727,639	1,691,070	1,652,902	1,886,763
Prepared or preserved—										
Canned........................		560,612		597,759		719,580		580,048		658,739
Other.........................		667,761		745,697		785,076		929,742		1,021,625
Total prepared or preserved.....................		1,228,373		1,343,456		1,504,656		1,509,790		1,670,364
Total vegetables............		2,546,287		2,543,488		2,603,374		3,200,860		3,567,127
Vinegar......................gallons..	95,675	19,754	103,417	18,072	132,450	19,192	111,994	17,158	92,027	16,266
Wines. (*See* Liquors, alcoholic.)										
Yeast.............................		8,439		24,675		18,772		21,215		23,099
Total vegetable matter, including forest products............		655,226,446		715,763,473		696,211,844		666,103,329		783,279,923
Total vegetable matter, excluding forest products............		606,297,682		657,482,349		626,126,055		602,903,981		706,304,492
Total agricultural exports, including forest products........		906,042,297		936,761,681		929,246,053		890,104,125		1,052,084,030
Total agricultural exports, excluding forest products........		857,113,533		878,480,557		859,160,264		826,904,777		975,108,599

LEGAL WEIGHTS PER BUSHEL.

[From Bureau of Standards, Department of Commerce and Labor.]

Legal weights (in pounds) per bushel.

State or Territory.	Apples.		Barley.	Beans.		Beets.	Blue-grass seed.	Bran.*	Broom-corn seed.	Buckwheat.	Carrots.	Clover seed.	Coal.	Coke.	Corn.			Corn meal, bolted.	Corn meal, unbolted.
	Apples.*	Dried apples.		Beans.*	Castor beans, shelled.										Corn in ear.	Shelled corn.	Corn meal.*		
U. S.			48		50					42			80				48		
Ala.		24	47	60											70	56	48		48
Ariz.			45	a 55												54			
Ark.	b 50	24	48	a 60			14	20	48	52		60			70	56	48		
Cal.			50							40						52			
Colo.			48	60			14			52		60	80		70	56	50		
Conn.	48	25	48	60		c 60		20		48	50	60	80			56			
Del.																56		44	48
Fla.	b 48	24	48	d 60	48			20							70	56	48		
Ga.		24	47	e 60			14	f 20		52		60	80		70	56	48		
Hawaii			48													56			
Idaho	b 45	28	48							42		60				56			
Ill.		24	48	e 60	46		14	20		52		60	80		70	56	48		
Ind.		25	48	60	46		14			50		60	80		g 68	56	50		
Iowa	48	24	48	60	46		14	20	30	52		60	80	38	70	56			
Kans.	b 48	24	48	60	46		h 14	20		50		60	80		70	i 56	50		
Ky.		24	47	e 60	*45		14	20		56		60	76		j 70	56	50		
La.			48													56			
Me.	44		48	60		60				48	50					56	50		
Mass.	48	25	48	k 60				20		48	50	60				l 56	50		
Mich.	48	22	48	60	46		14			48		60	80		70	56	50		
Minn.	b 50	28	48	60		50	14		57	50	45	60	80		70	56			
Miss.		26	48	e 60	46		14	20		48		60	80		72	56	48	44	48
Mo.	48	24	48	m 60	46		14	20		52	50	60	80		70	56	50		
Mont.	45		48	60		50	14	20		52	50	60	76		70	56	50		
Nebr.		24	48	e 60	46		14	20		52		60	80		70	56	50		
N. H.				62												56	50		
N. J.	50	25	48	60						50		64				56			
N. Y.	48	25	48	60				20		48	50	60				56	50		
N. C.			48							50		60				56		46	48
N. Dak.	50		48	60		60		20	30	42		60	80		70	56			
Ohio	50	24	48	60		56				50	50	60	n 80	40	68	56			
Okla.			48	60		60		20	30	42		60	80		70	56			
Oreg.	45	28	46							42		60				56			
Pa.			47							48		60	o 76	40		56			
R. I.	48	25	48	60	46	50		20		48	50	60	80	40	70	56	50		
S. C.																	48	46	48
S. Dak.			48	60		60		20	30	42		60	80		70	56			
Tenn.	b 50	24	48	p 60	46	50	14	20	42	50	50	q 60	80	40	70	56		50	48
Tex.	45	28	48	e 60				20		42		60	80		70	56			
Vt.	46		48	62		60				48	50	60				56			
Va.		28	48	e 60			14			52		60	80		70	56	50		
Wash.	b 45	28	48							42		60				56			
W. Va.		25	48	60						52		60	80			56			
Wis.	50	25	48	60		50		20		50	50	60				56	50		

* Not defined.
a Small white beans, 60 pounds.
b Green apples.
c Sugar beets and mangel-wurzels.
d Shelled beans, 60 pounds; velvet beans, 78 pounds.
e White beans.
f Wheat bran.
g Corn in ear, 70 pounds until Dec. 1 next after growth; 68 pounds thereafter.
h English blue-grass seed, 22 pounds; native blue-grass seed, 14 pounds.
i Rice corn.
j Corn in ear from Nov. 1 to May 1 following, 70 pounds; 68 pounds from May 1 to Nov. 1.
k Soy beans, 58 pounds.
l Cracked corn, 50 pounds.
m Green unshelled beans, 30 pounds.
n Cannel coal, 70 pounds.
o Standard weight in borough of Greensburg, 75 pounds.
p Dried beans; green unshelled beans, 30 pounds.
q Red and white.

Legal weights (in pounds) per bushel—Continued.

State or Territory.	Cotton seed.		Cranberries.	Flaxseed (linseed).	Gooseberries.	Plastering hair.	Hemp seed.	Herds grass.	Hungarian grass seed.	Millet.	Oats.	Onions.		Orchard grass seed.	Osage orange seed.	Parsnips.	Peaches.		
	Cotton seed.*	Sea island.										Onions.*	Onion sets.				Peaches.*	Dried, peeled.	Dried, unpeeled.
U. S.				56							32								
Ala.	32										32							38	33
Ariz.											32								
Ark.	33½			56						50	32	57						33	33
Cal.											32								
Colo.							44				32	57							
Conn.	30	44		55				45			32	52				45		33	33
Fla.	32	46								50	32	56					[a]54	33	
Ga.	30			56		8	44				32	57						38	33
Hawaii											32								
Idaho				56							36								28
Ill.				56		8	44				32	57							33
Ind.			33				44			50	32	48		14	33	55			33
Iowa				56	40		44		50	50	32	57			32		48		33
Kans.				56		[b]8	44		50	50	32	57							33
Ky.				56		8	44		50	50	32	57	[e]38	14				39	
Me.						11		45			32	52				45			
Md.											26								
Mass.	30	44		55				45			32	52						33	
Mich.			40	56			44		50	50	32	54		14	33			28	
Minn.			36		40	[b]8	50		48	48	32	52		14		42		28	
Miss.	32			56			44		50	50	32	57						33	
Mo.	33			56			44		48	50	32	57	[d]28	14	36	44	48	33	
Mont.				56			44		50		32	57				50			
Nebr.				56		8	44		50	50	32	57	25		32			33	
N. H.											32								
N. J.				55							30	57						33	
N. Y.	30	44		55				45			32	57						33	
N. C.	30			55							32								
N. Dak.				56						50	32	52							
Ohio				56			44		50	50	32	55					48	33	
Okla.				56							32	52							
Oreg.											32							28	
Pa.											32	50							
R. I.	30	44		56			44		50	50	32	50				50	48	33	
S. C.	30																		
S. Dak.				56							32	52							
Tenn.	28			56	48	8	44		48	50	32	56	[c]28	14	33	50	[f]50	26	
Tex.	32			56			44		48	50	32	57					50	28	
Vt.								45			32	52							
Va.	32			56		8	44	12	48	50	30	57	28	14	34			40	32
Wash.				56							32							28	
W. Va.				56							32							33	
Wis.	30	44		56		8	44		48	50	32	57				44		33	

* Not defined.
[a] Green.
[b] Unwashed plastering hair, 8 pounds; washed plastering hair, 4 pounds.
[c] Bottom onion sets.
[d] Top onion sets.
[e] Button onion sets, 32 pounds.
[f] Matured.

Legal weights (in pounds) per bushel—Continued.

State or Territory.	Peanuts.	Pears.*	Pease.		Potatoes.	Sweet potatoes.	Redtop seed.	Rough rice.	Ruta-bagas.	Rye meal.	Rye.	Shorts.*	Sorghum seed.	Tomatoes.	Timothy seed.	Turnips.	Wheat.
			Green pease, unshelled.	Peas.*													
U. S.	....	....	....	60	60	....	....	....	....	....	56	....	....	....	....	....	60
Ala.	....	....	....	60	60	55	....	....	....	....	56	....	....	....	....	55	60
Ariz.	....	....	....	....	....	....	....	....	....	....	56	....	....	....	....	....	60
Ark.	....	....	....	60	60	50	14	....	....	....	56	....	50	....	60	57	60
Cal.	....	....	....	....	....	....	....	....	....	....	54	....	....	....	....	....	60
Colo.	....	....	....	....	60	....	....	....	....	....	56	....	....	....	45	....	60
Conn.	....	....	....	60	60	54	....	45	60	50	56	20	....	....	....	50	60
D. C.	....	....	....	....	60	....	....	....	....	....	....	....	....	....	....	....	....
Del.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60
Fla.	....	....	....	....	60	60	....	....	....	....	56	....	56	....	....	54	60
Ga.	....	....	....	60	60	55	....	43	....	....	56	....	....	....	45	55	60
Hawaii.	22	60	....	....	....	....	....	....	....	....	56	....	....	....	....	....	60
Idaho.	....	[a] 45	....	....	60	....	....	....	....	....	56	....	....	....	....	....	60
Ill.	....	....	....	....	60	50	....	....	....	....	56	....	....	....	45	55	60
Ind.	....	....	....	....	60	55	....	....	....	....	56	....	....	....	45	55	60
Iowa.	....	....	....	....	60	46	....	....	....	....	56	....	[b] 30	....	45	....	60
Kans.	....	....	....	....	60	50	....	....	....	....	56	....	56	....	45	55	60
Ky.	....	....	....	60	60	55	....	....	....	....	56	....	....	....	45	60	60
La.	....	....	....	....	....	....	....	....	....	....	56	....	....	....	....	....	60
Me.	....	....	....	60	60	....	....	....	60	50	50	....	....	....	....	50	60
Md.	....	....	....	....	56	....	....	....	....	....	....	....	....	60	....	....	....
Mass.	....	....	....	60	60	54	....	45	....	50	56	20	....	....	45	....	60
Mich.	....	....	....	60	60	56	14	....	....	....	56	....	....	....	45	58	60
Minn.	....	....	....	60	60	55	14	....	52	....	56	....	57	....	45	....	60
Miss.	....	....	....	60	60	60	....	....	....	....	56	....	42	....	45	55	60
Mo.	....	48	56	[c] 60	60	56	14	....	50	....	56	....	42	45	45	42	60
Mont.	....	45	....	60	60	....	....	....	....	....	56	....	....	....	45	50	60
Nebr.	....	....	....	60	60	50	....	....	....	....	56	....	30	....	45	55	60
N. H.	....	....	....	60	60	....	....	....	....	50	56	....	....	....	....	....	60
N. J.	....	....	....	60	60	54	....	....	....	....	56	....	....	....	....	....	60
N. Y.	....	....	....	60	60	54	....	45	....	50	56	20	....	....	45	....	60
N. C.	22	....	....	60	....	....	....	44	....	....	56	....	....	....	....	....	60
N. Dak.	....	....	....	60	60	46	....	....	....	....	56	....	....	....	45	60	60
Ohio.	....	....	....	60	60	50	....	....	....	....	56	....	....	56	45	60	60
Okla.	....	....	....	60	60	46	....	....	....	....	56	....	....	....	42	60	60
Oreg.	....	45	....	....	60	....	....	....	....	....	56	....	....	....	....	....	60
Pa.	....	....	....	....	56	....	....	....	....	....	56	....	....	....	....	....	60
R. I.	....	....	....	[c] 60	60	54	....	....	....	50	56	20	....	56	45	50	60
S. Dak.	....	....	....	60	60	46	....	....	....	....	56	....	....	....	42	60	60
Tenn.	23	[d] 56	30	60	60	50	14	....	....	....	56	....	50	56	45	50	60
Tex.	....	....	....	....	60	55	....	....	....	....	56	....	....	55	45	55	60
Vt.	....	....	....	60	60	....	....	....	....	....	56	....	....	....	45	60	[e] 60
Va.	22	....	....	60	56	56	12	....	....	....	56	....	....	....	45	55	60
Wash.	....	[a] 45	....	....	60	....	....	....	....	....	56	....	....	....	....	....	60
W. Va.	....	....	....	....	60	....	....	....	....	....	56	....	....	....	45	....	60
Wis.	....	....	....	60	60	54	....	45	56	50	56	20	....	....	45	42	60

* Not defined.
[a] Green.
[b] Sorghum saccharatum seed.
[c] Including split peas.
[d] Dried pears, 26 pounds.
[e] India wheat, 46 pounds.

Commodities for which legal weights per bushel have been fixed in but one or two States.

[From Bureau of Standards, Department of Commerce and Labor.]

Article.	Weight.	States.
	Pounds.	
Apple seeds	40	Rhode Island and Tennessee.
Beggar-weed seed	62	Florida.
Blackberries	32	Iowa. Tennessee, 48 pounds; dried, 28 pounds.
Blueberries	42	Minnesota.
Bromus inermis	14	North Dakota.
Cabbage	50	Tennessee.
Canary seed	60	Do.
Cantaloupe melon	50	Do.
Cement	80	Do.
Cherries	40	Iowa. Tennessee, with stems, 56 pounds; without stems, 64 pounds.
Chestnuts	50	Tennessee. Virginia, 57 pounds.
Chufa	54	Florida.
Cotton seed, staple	42	South Carolina.
Cucumbers	48	Missouri and Tennessee. Wisconsin, 50 pounds.
Currants	40	Iowa and Minnesota.
Feed	50	Massachusetts.
Grapes	40	Iowa. Tennessee, with stems, 48 pounds; without stems, 60 pounds.
Guavas	54	Florida.
Hickory nuts	50	Tennessee.
Hominy	60	Ohio. Tennessee, 62 pounds.
Horse-radish	50	Tennessee.
Italian rye-grass seed	20	Do.
Johnson grass	28	Arkansas.
Kafir corn	56	Kansas.
Kale	30	Tennessee.
Land plaster	100	Do.
Middlings, fine	40	Indiana; coarse, 30 pounds.
Millet, Japanese barnyard	35	Massachusetts.
Mustard	30	Tennessee.
Plums	40	Florida. Tennessee, 64 pounds.
Plums, dried	28	Michigan.
Pop corn	70	Indiana and Tennessee. Ohio, in the ear, 42 pounds.
Prunes, dried	28	Idaho; green, 45 pounds.
Quinces	48	Florida, Iowa, and Tennessee.
Rape seed	50	Wisconsin.
Raspberries	32	Kansas. Tennessee, 48 pounds.
Rhubarb	50	Tennessee.
Sage	4	Do.
Salads	30	Do.
Sand	130	Iowa.
Spelt or spiltz	40	North Dakota. South Dakota, 45 pounds.
Spinach	30	Tennessee.
Strawberries	32	Iowa. Tennessee, 48 pounds.
Sugar-cane seed	57	New Jersey.
Velvet-grass seed	7	Tennessee.
Walnuts	50	Do.

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